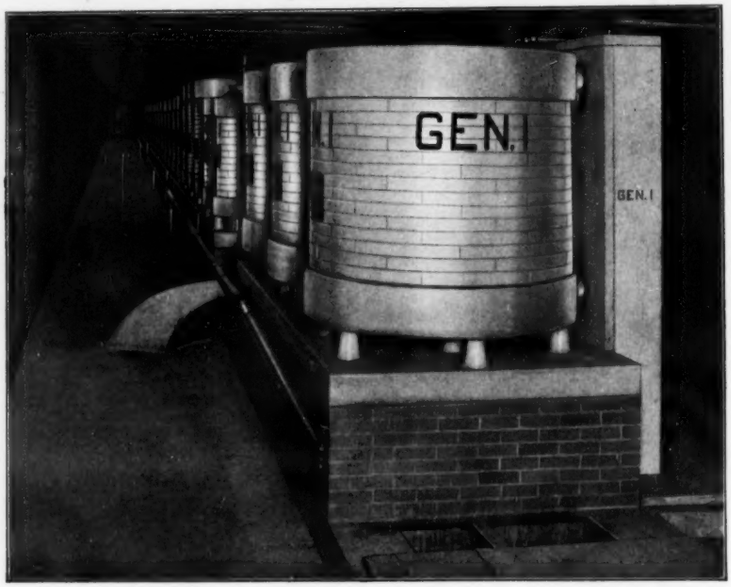
Founded 1874—Fifty-One Years of Service

Electrical World

McGraw-Hill Company, Inc. November 14, 1925 Twenty-five Cents Per Copy

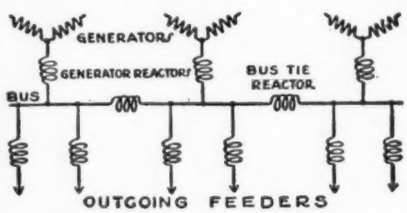
Wings
for machinery
The flying speeds of modern machinery have largely been made possible through the production of such lubricants as high-grade Gargoyle Lubricating Oils.
Based upon 59 years of experience, the Vacuum Oil Company has produced the correct grades of oils for every type of turbine, internal combustion engine, steam cylinder engine, and every other known form of machinery.
Ask a representative of the Vacuum Oil Company to recommend to you the correct grades of these reliable lubricants for all your machinery.
Domestic Branches: New York (Main Office)
Des Moines Minneapolis Pittsburgh
Detroit New Haven Portland, Me.
Indianapolis Oklahoma City Rochester
Kansas City, Mo. Peoria Springfield, Mass.
Milwaukee Philadelphia St. Louis
GARGOYLE
Lubricating Oils
VACUUM OIL COMPANY

Row after Row of Metropolitan Reactors



Protect New York City's Super Power Stations

Here is a row of Metropolitan Reactors that protects one of the giant plants of the New York Edison Co. This company operates two large plants and has 100% generator protection supplied by Metropolitan Current Limiting Reactors.



Another large system in New York is the United Electric Light & Power Co., which has a total of more than 500 Metropolitan Reactors protecting its generators—bus ties and outgoing feeders. Metropolitan is the best short circuit protection that money can buy, and to show the demand for these reactors both in the central station and industrial fields, a list of installations in leading companies is given below. Write our engineers for full details.

List of Installations

Bronx Gas & Elec. Co., New York
Brooklyn Edison Co., Brooklyn, N. Y.
Brooklyn Rapid Transit Co., Brooklyn, N. Y.
Calgary Municipal Elec. Co., Calgary, Canada
Cataluna Power Co., Barcelona, Spain
Chicago, Lake Shore & South Bend R. R.
Cohoes Light & Power Corp., Cohoes, N. Y.
Commonwealth Edison Co., Chicago, Ill.
Consolidated Gas Elec. Lt. & Power Co., Baltimore, Md.
Dayton Power & Light Co., Dayton, Ohio
Detroit Edison Co., Detroit, Mich.
East Hampton Gas Co., East Hampton, Mass.
Edison Elec. Ill. Co., Boston, Mass.
El Paso Power & R. R. Co., El Paso, Texas
French General Electric Co., Paris
Hydro Electric Power Commission, Toronto.
Havana Elec. Ry., Lt. & Power Co., Havana, Cuba
Illinois Steel Co., Gary, Ind.
Interborough Rapid Transit Co., New York
Kings County Gas & Electric Co., Brooklyn, N. Y.
Merced Irrigation Dist., San Francisco, Cal.
Municipal Gas Co., Albany, N. Y.
New York Edison Co., New York
N. Y., N. H. & H. R. R. Co.
N. Y. & Queens Elec. Lt. & Power Co.
Philadelphia Electric Co, Philadelphia, Pa.
Potomac Electric Co., Washington, D. C.
Public Works Department, New Zealand
Public Service Electric Co., Newark, N. J.
Shawinigan Hydro Elec. Power Co.
Southern Wisconsin Power Co., Madison, Wisc.
Tennessee Power Co., Chattanooga, Tenn.
Toledo R. R. & Lt. Co., Toledo, Ohio
Toronto Power Co., Niagara Falls, Ont.
Turners Falls Power Co., Turners Falls, Mass.
United Electric Lt. Co., Springfield, Mass.
United Elec. Lt. & Power Co., New York
Union Gas & Electric Co., Cincinnati
Union Elec. Lt. & Power Co., St. Louis, Mo.
U. S. Explosive Plant, Nitro, West Va.
Utica Gas & Electric Co., Utica, N. Y.
Victoria Falls & Transvaal Power Co., Simerpan, South Africa
Westchester Lighting Co., Mount Vernon, N. Y.
Yonkers Elec. Lt. & Power Co., Yonkers, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

METROPOLITAN DEVICE CORPORATION
Manufacturers of the Murray Protective Devices
1250 Atlantic Avenue, Brooklyn, N. Y.

Electrical World

Published by McGraw-Hill Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 86 — *New York, Saturday, November 14, 1925* — NUMBER 20

Harbingers of Prosperity

NOT only Florida but the entire region of which it is a part is reaping benefit from the influx of population to the state just named. The resources, power facilities and labor advantages of the Southern States have long been known to the well informed. As a result of the Florida boom knowledge of the great industrial development going on in these states is being carried by travelers to the remotest parts of the nation.

The electrical industry in the South years ago realized the possibilities before it, and it has invested about four hundred million dollars in utility properties. Interconnections have been made, transmission lines have been built in all directions, and a great deal has been done by the industry directly to bring industries into that territory. Power is now available in quantity and at a relatively low cost all through these states, and the new South finds that its greatest asset for attracting industries lies in the great electrical systems ready for giving service. The electrical industry, indeed, anticipated the present developments and made rapid industrial growth possible.

At the present time interconnected 110-kv. lines traverse the territory. These are rapidly becoming so heavily loaded that it is anticipated large power trunk lines will be necessary in the near future. The water powers of the Appalachians, both on the east and west slopes, and coal-burning plants in West Virginia, Kentucky, Tennessee and Alabama will be interconnected by major lines to give a type of superpower unknown in other areas. This will come about because the water powers are seasonal and require that storage shall be utilized fully and because the loads are large and spread over all parts of the territory. No part of the country is growing more rapidly or has better possibilities than the South, and it is a matter of legitimate pride to the electrical industry that it was the first to grasp the opportunities existing there.

Costs of Service Need Accurate Analysis

NEARLY all utility executives, rate experts and economists are now accepting the principles of the three-part rate for fabricating rate structures even if the final rate does not appear in a three-part form. The three-part structure has been applied most extentively to large power users and secondarily to commercial customers. It is also being used in modified form by some utilities which are trying to put rural service on an economic basis. Some companies feel that while it is the most equitable rate structure, it is too complicated to be explained to domestic customers and too unwieldy for billing purposes. For this reason step rates or the equivalent of a service charge plus step rates built on the three-part rate principle are applied instead.

It is questionable, however, whether the majority of utility companies have thoroughly analyzed and accurately determined the expenses which should be assessed to the customer-service, demand-expense and energy-cost elements of the three-part rate. More frequently approximate figures are determined for these elements or the rates merely fabricated to encourage business and produce the necessary revenue for that class of business. Every company recognizes the high ratio of consumer and demand cost and the low ratio of energy cost to total cost of service. Some would like to make the low-load-factor customer pay more of his proportionate share, but others contend that to make the use of service more nearly universal the high-load-factor customer will have to help support the low-load-factor customer.

Regardless of what final rate structure is adopted or the values attached to each part, holding companies at least can well profit by analyzing and determining the expenses chargeable to each part of a three-part rate.

The Best Fruits of Association Work

MEN often say that the electrical industry is over-organized, with too many meetings and too many conventions held at too great cost in time and money. From one point of view it does occasionally seem so, but the fact remains that electrical men as a class are conscious and proud of the fact that in this industry there is a spirit of fellowship and co-operation beyond comparison with the other industries about us. And unquestionably this is a priceless product of our many meetings.

Owen D. Young, chairman of the board of the General Electric Company, in a recent address before a very distinguished gathering of electrical executives made this interesting analysis of the inner influence of association work. In the old days, he said, business was entirely local. The merchant and the manufacturer lived in the same community with their customers, and the church provided the natural meeting place where they came together and professed their principles. The public checked the commercial ethics of the business man as he practiced them on weekdays against his Sunday character and knew that he was honest and trustworthy—or not. So the church exercised upon local industry both a restraint against overzealous, selfish trading and a protection against popular misunderstanding.

But time brought great changes. Industry became national in scope. The manufacturer reached out and found his customers more and more among people who could never know him as a man, and so gradually he lost that public confidence that had been so soundly founded on human acquaintanceship and sympathy. For when his customers could no longer measure his business policies against his personal ethics, because the

church no longer provided a meeting place, they began to question his policies and doubt his fairness and to suspect the methods and the motives of those men of industry whom they did not know. In a word, business had become too highly technical and specialized to measure by the old tests of unselfishness and honesty. "In former days," as Mr. Young expressed it, "the man who sold a kicking horse as kind and gentle was soon found out and the buyer could protect himself, but the modern manufacturer can market a spavined motor represented as a sound one and the purchaser is powerless to gage his motor by the man's own personal character." Moreover, men began to do things in business that they would not have done in local life because they had lost the restraint that had come out of personal contact and accountability. Public opinion became alarmed and expressed itself in restrictive legislation.

The great opportunity of the industry association, Mr. Young believes, lies in its friend-making function. The American people can no longer check the business policies of electrical manufacturers, for instance, against the individual character of the men who guide that industry. Public opinion in each community cannot be satisfied in the old-time way. But the electrical industry has now become a great community of itself, and the industry association is establishing a forum which, like the church, provides a meeting place where men profess their principles openly to the electrical community. And these professions can be checked against the acts of the organizations which they represent.

Thus the old restraint of an informed and observing community opinion is steadily becoming a more active influence in our industry, and as this fact is more widely known and accepted by the American public the old friendly confidence will not be wanting. It is highly important, therefore, that this association work be viewed with a broad, patient philosophy and that these fruits of simple human friendship between electrical men be generously nourished and increased.

Relay Versus Trunk-Line Power

IN SOME sections of the country large blocks of power are transmitted great distances over high-voltage lines. In the South, however, power is relayed from property to property as the necessity occurs, and for this purpose 110-kv. lines have been found adequate. The relay principle works out splendidly for the interconnected properties in the South, and the investment cost of long-distance high-tension lines is eliminated. It is successful because each property is normally self-sustaining and has its own steam and hydro plants. In addition, the distance between properties is short, and each property has a rather compact service territory with distributed load centers and generating stations at several locations.

Thus, if energy is desired in the Carolinas from Alabama or Tennessee, it is obtained by block relaying from property to property. For example, the Alabama Power Company carries load of the Georgia Railway & Light Company, the Georgia Railway & Light Company carries load of the Southern Power Company and the Southern Power Company carries load of the Carolina Power & Light Company. The equivalent effect is that of energy being transmitted from Alabama to the Carolinas, or vice versa, while actually no energy is transmitted any great distance. In many years of operation the relay principle has worked out to the advantage of all the interconnected companies, and little, if any, benefit would be derived by erecting a superstructure of long high-voltage lines in the territory. Future progress seems to lie in the direction of making possible more relay interconnections and the erection of a substructure distribution network so as to tap the 110-kv. network at important load centers only.

Applications of the relay principle to other properties in other territories might well be studied carefully in connection with projects for erecting a "super" line to take advantage of diversity or to give service insurance. Normally inoperative investments should be avoided if possible.

The Kennelly-Heaviside Layer

RECENT experimental investigations in radio telegraphy, concerning the relations between distance of transmission and wave length, have caused increasing speculation as to the properties of the conducting layer long suspected to exist in the outer atmosphere of the earth. This layer is often spoken of as the "Heaviside layer." The association of the name of the great English mathematician is probably due, first, to his suggestion of the importance of such a layer, in his article on "Telegraphy" in the Encyclopædia Britannica, and, second, to his extensive mathematical analysis of electromagnetic wave propagation. It is worth noting, however, that Heaviside was not the first to refer to a probable electrical conductivity in the upper layers of the earth's atmosphere.

Even before Marconi's practical development of a method of signal transmission, based on Hertz's great discoveries, J. J. Thomson had pointed out the increased conductivity of air at very low pressures, and it was realized generally that such conductivity must necessarily exist in the low-pressure regions of the upper atmosphere. This idea was immediately seized upon by geophysicists as a possible factor in such terrestrial phenomena as the aurora and the earth's magnetism. Balfour Stewart in 1882 suggested that the motion of large bodies of air through the magnetic field of the earth might account for the diurnal variations of the earth's magnetic field, provided that the air possessed electrical conductivity. Schuster, in 1887, having shown that a source of ionization renders the neighboring air conducting, proved that the diurnal magnetic variation could not be due to forces inside the earth but might be due to currents outside, that is, in the upper atmosphere, if an ionizing source were present.

The discovery of wireless telegraphy and radio transmission about the curvature of the earth soon developed a new importance for the upper conducting air as a reflecting medium for electromagnetic waves. Apparently the first scientist to call public attention to its importance and to outline the influence which it should have in wireless transmission was A. E. Kennelly in an article in the ELECTRICAL WORLD of March 15, 1902. Heaviside's brief and somewhat casual comment appeared a few months later in the article referred to above. Heaviside's numerous contributions contain analyses of the transmission and reflection of electromagnetic waves in their relation to many shapes of conducting surface, including that of reflection from a plane. The combination has apparently been sufficient

to start a widespread impression that he was the first to suggest the importance of the upper conducting layer as a factor in radio transmission. In view of the facts outlined above, however, it would appear that while the existence of such a conducting layer was recognized even before the discovery of radio telegraphy, the first public suggestion of its importance in the latter great field is due to Kennelly. On the other hand, the announcement of Heaviside followed so closely, and his studies of the reflection of electromagnetic waves were so extensive, that it would appear that the names of both of these distinguished scientists should be associated with the conducting layer. If this estimate of the relative values of the facts is correct, it would therefore be eminently proper in speaking of the upper conducting layer to call it the "Kennelly-Heaviside layer."

Economy of Purchased Power

THE fact that fifty-two out of fifty-eight of the hotels in Chicago now purchase power in preference to operating private plants serves as a practical demonstration of the superiority and economy of central-station service. In the last ten years every new Chicago hotel has contracted for purchased power and none has installed a private plant. Such a record bespeaks the efficiency of the Commonwealth Edison Company's power sales department and represents the cumulative effect of a good many years' patient missionary work.

The value of the space required for a private power plant, high interest and depreciation charges against this equipment, which does not contribute to the hotel's earning capacity, and a correct appraisal of the relative steam requirements for building heating and power and light have been the principal determining influences in all of these Chicago hotel installations. These same factors in varying degrees exist wherever power and light are used, whether it is a commercial or industrial operation, and where a careful and honest analysis of conditions is made the economy of purchased power becomes evident. The experience of the fifty-two Chicago hotels leads to the definite conclusion that it is far cheaper to buy power than to make it.

Obsolete Lighting Fixtures Are Still Numerous in Homes

LIGHTING experts are not in sympathy with certain trends in fixture design evident in recent years, although improvement is manifest by the tendency to install shades on fixtures. However, quite aside from the question of the satisfactoriness of modern fixtures, there is still a startingly high percentage of obviously obsolete fixtures in use in this country at the present time. A recent extensive survey by M. Luckiesh indicates that one-third of the ceiling fixtures in use in the homes are unquestionably obsolete. The percentage of obsolete ceiling fixtures in living rooms and dining rooms is about 16 per cent, in bedrooms and bathrooms about 52 per cent and in kitchens about 63 per cent. Even to those who follow lighting development very closely these seem astonishing percentages. The replacement of these fixtures with modern ones of very moderate cost means a total business in fixtures of about two hundred million dollars. In a city of three hundred thousand population there is a total business in fixtures and portable lamps of about ten million dollars if all the wired homes are to be provided with proper lighting equipment purely from a utilitarian viewpoint.

With unquestionably obsolete ceiling fixtures in 63 per cent of the kitchens, it is seen that there still are great opportunities for kitchen-unit campaigns such as have been successfully carried on by a number of companies. One-third of the ceiling fixtures in the kitchens have no shades, and it is well known that many so-called shades are not satisfactory. The wattage of lamps used in the kitchen can easily be doubled by using proper lighting equipment.

In the dining room 17 per cent of the ceiling fixtures are unquestionably obsolete, and a much greater percentage are unsatisfactory and can be improved upon. In the various rooms of the home from 10 per cent to 33 per cent of the lamp bulbs are without shades. If one proceeds in this manner throughout the home with only the matter of obsolescence in mind, much opportunity will be disclosed for educational work and better business, as is shown by the third article in the series by M. Luckiesh, which appears in this issue.

Interconnection and System Reserves

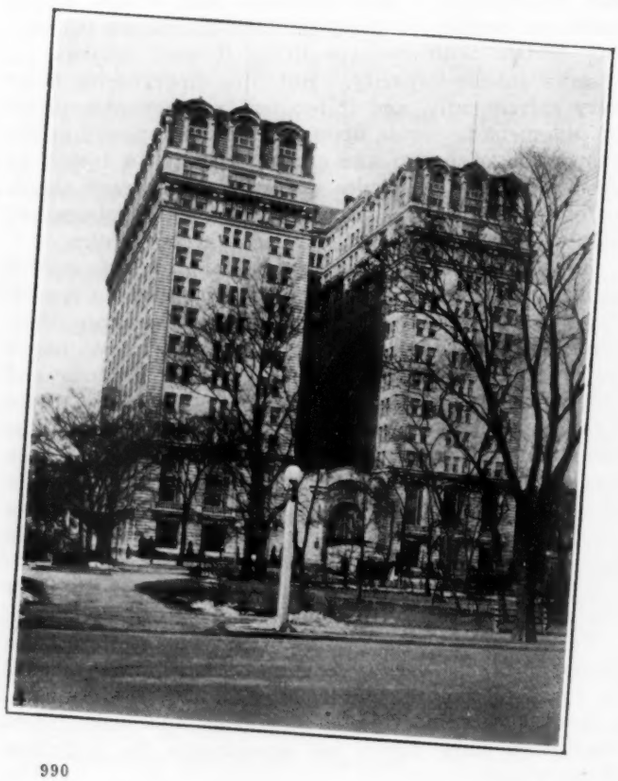
THE use of interconnection to diminish the amount of reserve generating capacity required on each component system introduces several features that require study. This is especially true as regards the interconnection of combined steam and hydro-electric systems, all-steam systems and all-hydro systems which are separately owned. Under any emergency condition, such as a water shortage or a severe storm, every utility management and every state utility commission would hold that the primary duty of each company was to serve its own customers and not to supply power to other systems even though contracts had been made. Each property would be bound to do its utmost to care for its own needs, and therefore each system should build and develop its plant as a self-sustaining generating system with perhaps little, if any, decrease in reserve station capacity. But dire emergencies occur very infrequently, and it becomes a practical question of judgment to decide upon the reserve capacity or the proportion of hydro and steam capacity to install on each property. A service and economic balance should be obtained after a thorough study of all systems and all conditions found in the interconnected group.

Even though an adequate installation of station capacity is made, there remain many operating regulations to be established. For example, on a large interconnected group where some properties have ample water-storage facilities and limited steam capacity and other properties have little water storage and more steam capacity something can be done to equalize the interconnected reserve. During the rainy season the total steam capacity and the stream-flow hydro plants should be utilized fully and the water-storage reservoirs should be filled and held in reserve for later use. To do this, however, requires a close co-ordination of properties, a study of costs for energy purchased at different times and analysis of the connected group as a whole.

To realize the full value of interconnection it is apparent that a very competent group of men should be formed from the different properties to formulate policies, determine rules of operation and make interconnection plans which will co-ordinate the activities of every unit.

Five of Chicago's Fifty-two Hotels Using Central-Station Service

IN CHICAGO nearly all of the hotels have found it far more economical to purchase electric energy from the Commonwealth Edison Company than to install and operate their own power plants. Some of the larger hotels which buy power are shown here: (1) Drake Hotel, (2) Edgewater Beach Hotel, (3) Old Palmer House, (4) Belden Apartment Hotel, (5) Hotel Sherman.

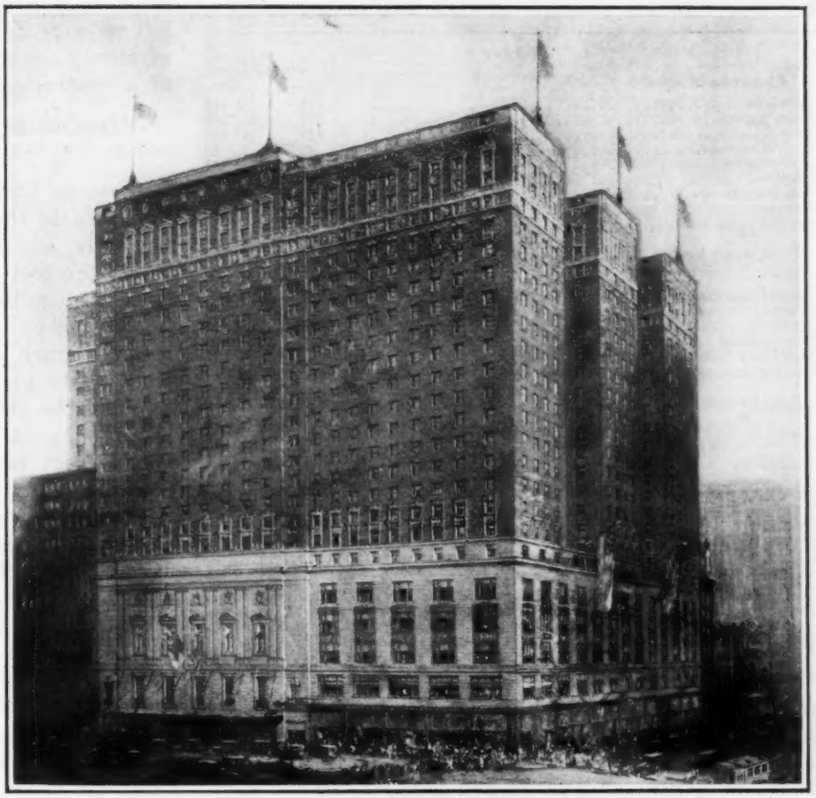


Selling Power to Hotels

Fifty-two Out of Fifty-eight Chicago Hotels, with Combined Maximum Demand of 8,000 Kw., Purchase 37,000,000 Kw.-Hr. Annually — Value of Space and Greater Investment Return Important Argument in Contracting with New Palmer House for 3,650-Kw. Demand

HOTELS are considered by many as the most difficult power business to secure as they have such a diversity of demand and such extensive opportunity to utilize steam for purposes other than generated power. For these reasons many advocates of private plants think that hotels are in a position to make power more cheaply than they can buy it. The decision of the management of the new Palmer House in Chicago to purchase all its power from the Commonwealth Edison Company is evidence of the belief of hotel managers, in Chicago, at least, that purchased power is more desirable than power from a private plant.

The new Palmer House, now building, will be the largest hotel in the world and will purchase all its electrical energy requirements for power, lighting and cooking. The total electric installation will amount to approximately 6,600 kw. of connected load, with a maximum demand of 3,650 kw. and with an annual energy consumption of 20,000,000 kw.-hr. Details of this installation are given in Table I.



NEW PALMER HOUSE—WORLD'S LARGEST HOTEL—WILL USE 6,600 KW. IN CENTRAL-STATION SERVICE

The practically unanimous use of purchased power by hotels in Chicago constitutes one of the strongest arguments for the use of purchased power in any commercial establishment. The Commonwealth Edison Company is now serving fifty-two hotels, according to information supplied by George H. Jones, power engineer. During the past ten years every hotel built in Chicago has contracted for purchased power rather than operate a private plant. Of the many hotels that formerly operated private plants, only six have continued to date with their own power. Considering the great number of important hotels in Chicago, this record is remarkable.

Among important hotels using Commonwealth Edison service may be mentioned the Sherman, Drake, Blackstone, Morrison, Atlantic, Brevoort, Hyde Park, Edgewater Beach, Windemere, Plaza, Belden, Webster, Parkway, Sisson, Sheridan-Plaza and Cooper-Carlton. These and other Chicago hotels have demands ranging from 100 kw. to 700 kw. and purchase 37,000,000 kw.-hr. anually, with a combined maximum demand of more than 8,000 kw. The addition of the new Palmer House will bring the hotel load of the Commonwealth Edison Company to a maximum demand of 12,000 kw. and an annual consumption of nearly 60,000,000 kw.-hr. In addition to this large hotel load the Commonwealth Edison serves all the large club buildings, the load requirements of which are comparable to hotels.

Before taking up the arguments for purchased power in hotels it is well to consider the problem that exists by reason of the nature of hotel load conditions. Few industrial plants have better load factors than have large hotels. Few plants have opportunity to make better use of waste heat than has the modern hotel with its tremendous demand for building heating, hot water and energy requirements of every kind. The load factor of the new Palmer House will be approximately 63 per cent, which is considerably better than the load factor of many large central stations. Furthermore, the requirements for heating and hot water in a hotel of this size would make possible the utilization of waste heat to the maximum advantage. An analysis of the heat and hot water requirements of a modern hotel is shown graphically in Fig. 1. This figure shows the combined average steam requirements for every month of the year for one of Chicago's large hotels. This chart also indicates the relative importance of the various classes of heating loads in the modern hotel

and shows the great uniformity of the hot water and miscellaneous steam requirements compared with the general building heating load.

Under the conditions outlined, it might seem that business such as hotels offer could be obtained only at an extremely low rate compared with the rate to other commercial and industrial establishments. The facts are, however, that in Chicago the load of the new Palmer House as well as that of all large hotels has been obtained without resort to special rates of any kind. The Commonwealth Edison Company has signed its hotel business on its standard rate schedule for large light and power customers. This schedule includes both demand and energy charges, which automatically gives the customer a rate based upon quantity and load factor. This schedule is of the same general form as those used by large power companies throughout the country and the average net rate earned does not differ materially from that earned by large customers of other power companies.

TABLE I—ELECTRIC LOAD OF NEW PALMER HOUSE, CHICAGO

Power

Character of Service	Connected Load Hp.	Connected Load Kw.
Elevators	1,355	1,016
House pumps	200	150
Fans	924	693
Kitchen motors	40	30
Refrigeration	460	345
Ejectors	150	113
Vacuum cleaners	60	45
Blowers	90	68
Miscellaneous motors	78	59
Total power load	3,357	2,519

Lighting

General lighting sixth to twenty-third floor	1,309
General lighting sixth floor and below	600
Corridors	128
Store lighting	700
Emergency lighting	127
Exterior lighting, floodlighting, signs, etc.	1,000
Total lighting load	3,864

Electric Heating

Kitchen, bakery and miscellaneous	196

Character of Service	Connected Load, Kw.	Simultaneous Maximum Demand Estimated, Kw.
Power	2,519	1,300
Lighting	3,864	2,200
Electric heating	196	150
Total	6,579	3,650

Load factor (estimated), 63 per cent; annual consumption, 20,000,000 kw.-hr. Number of guest rooms, 2,300. Note:—An unusually large amount of space will be used by stores on several floors, with the result that the building and load will be much larger than the number of rooms indicate. Cubical contents of building 21,423,000 cu.ft.

Power, light and heating requirements of modern hotels differ more in degree than in character. Greater use of certain services, such as electric cooking or extra lighting, may be made in certain hotels, but the general problems arising from the power requirements of modern hotels should be the same regardless of the city in which the hotels are located. A detailed analysis of the interrelation of light, heat and power requirements of the modern hotel may become very involved, because it is necessary to balance all uses for energy for every season of the year. Full consideration must be given to both operating costs and fixed charges when comparing purchased power with privately generated power.

The fixed charges on a modern hotel plant are very important. Because money must earn its interest rate, because a power plant begins to deteriorate and become obsolete the day it is installed and because a plant must be maintained and insured and taxes be paid upon it, there is entailed an expenditure for fixed charges on a private plant that amounts to a large sum of money. With modern hotel power plants costing as much as $500,000 exclusive of space requirements, and with fixed charges amounting to 15 per cent, the annual deduction from the hotel's earnings to pay these charges amounts to $75,000 a year. The conclusion reached by hotel managers, consulting engineers and the sales executives of the larger central stations is that the saving to a hotel in the purchase of power is generally equivalent to the fixed charges on a private plant and often is greater. The power bill may equal the bare operating costs of the private plant, but even so, there is left as a profit to the purchaser of power an amount of money equivalent to at least 15 per cent of the cost of a generating plant.

VALUE OF SPACE SAVED AN IMPORTANT ARGUMENT FOR PURCHASED POWER

A second important argument against private plants in hotels is the value of space. The power plant is generally located in the basement or sub-basement, where the cost of excavation, masonry, ventilation and material handling is very high. The cost of constructing a power plant in these underground locations becomes much greater than the construction of such a plant above ground.

While the value of space occupied by a power plant has been great enough to deter any recent Chicago hotels from building their own plants, not all hotel people realize the great economy in space that is effected by purchased power where the power plant has already been constructed or where auxiliaries are steam driven. A striking example of the saving in space effected by motor-driven auxiliaries, together with the great economy in operating costs, is found in the case of the Sherman Hotel of Chicago. This hotel, while buying its electric requirements, formerly operated three 350-hp. high-pressure boilers, an absorption ice machine and a great amount of auxiliary apparatus. The Piehl Engineering & Construction Company, Inc., made an investigation of steam plant conditions and carried out a complete reconstruction of the power and heating system on the basis of changing from high-pressure to low-pressure heating and use of central-station service for all auxiliaries. The remarkable saving in space effected is strikingly shown in the accompanying diagram, Fig. 2. The shaded areas show equipment in use under low-pressure heating system and central-station service. The unshaded areas represent equipment no longer required after the adoption of central-station service for auxiliaries and use of low-pressure steam for heating.

Evidence of the savings effected in the Sherman Hotel is found in the following quotation from a letter written by Miles Wilkinson, chief engineer, Hotel Sherman Company:

"The following figures show the net savings which we have made since C. F. Piehl changed our auxiliaries from steam to motor drive. They also changed the plant from high pressure to low pressure, which has been very satisfactory to us:

January, 1922	$1,004.00	July, 1922	$3,695.02
February, 1922	1,756.30	August, 1922	3,905.39
March, 1922	2,101.13	September, 1922	3,591.68
April, 1922	3,139.40	October, 1922	3,208.44
May, 1922	3,019.14	November, 1922	2,754.87
June, 1922	3,061.63	December, 1922	1,835.80
Total savings for one year			$33,072.80

"The above will serve to show the actual figures and I trust will furnish you the information which you desire. I might add that we are well pleased with the equipment and the plant, which operates very satisfactorily."

This interesting installation at the Sherman Hotel calls attention to the fact that in many cases the introduction of central-station service makes possible economies in other departments of the hotel that may be as great as those in the electric power plant and that cannot be obtained except by the adoption of central-station service for every light and power requirement.

Another argument against the investment by a hotel in a private plant is found in the fact that the fixed charges of 15 per cent generally charged against a private plant include an interest return of only 6 per cent on the money invested. This same money invested in the hotel proper would be expected to earn a return of at least 10 per cent and perhaps more. Therefore, the case of purchased power is a good one even where the power bill equals the combined operating and fixed charges of a private plant, as in such a case there would be a net gain for purchased power of 4 per cent on the value of the private plant. In the case of a hotel power plant costing $500,000 the management could afford to pay as much for purchased power as the combined operating and fixed charges on the private plant and there would still be left a profit of $20,000 a year to the credit of purchased power.

METHODS USED IN OBTAINING HOTEL BUSINESS

Fifteen years ago there were many private plants in Chicago hotels. Early efforts to obtain this load were met with many objections. The most common objection was that steam would be required for building heating and that, therefore, electric power was a byproduct. At

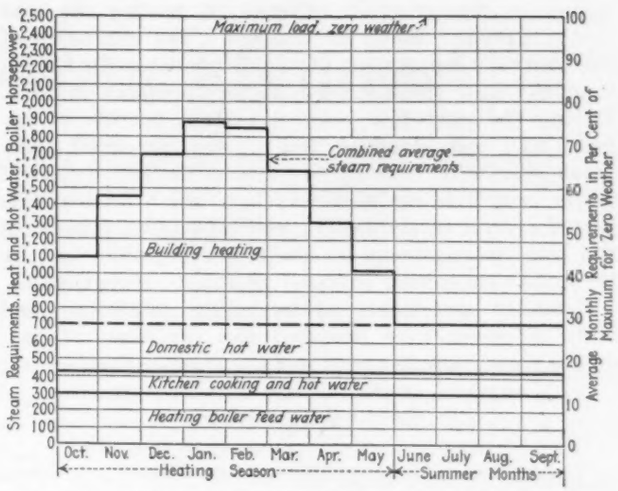

Maximum load, zero weather
Combined average steam requirements
Building heating
Domestic hot water
Kitchen cooking and hot water
Heating boiler feed water
Steam Requirments, Heat and Hot Water, Boiler Horsepower
Average Monthly Requirements in Per Cent of Maximum for Zero Weather
Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept.
Heating Season
Summer Months

FIG. 1—VARIATION IN COMBINED STEAM REQUIREMENTS OF MODERN HOTEL

that time detailed reports were made by the central-station sales engineers that showed all of the items of private plant cost and the effect that purchased power would have upon them. An important discovery during this period was the fact that the hourly demand for power does not coincide with the demand for steam heat. Another discovery was the fact that in the larger hotels, at least, the steam required for all heating purposes is less than that required for power and light. During the summer months the heating requirements for steam may be only half the power requirements. The results of these investigations showed that a private generating plant entailed a larger boiler plant and more coal than when purchased power was used. An idea of just how the power company went about obtaining this business may be had from the following

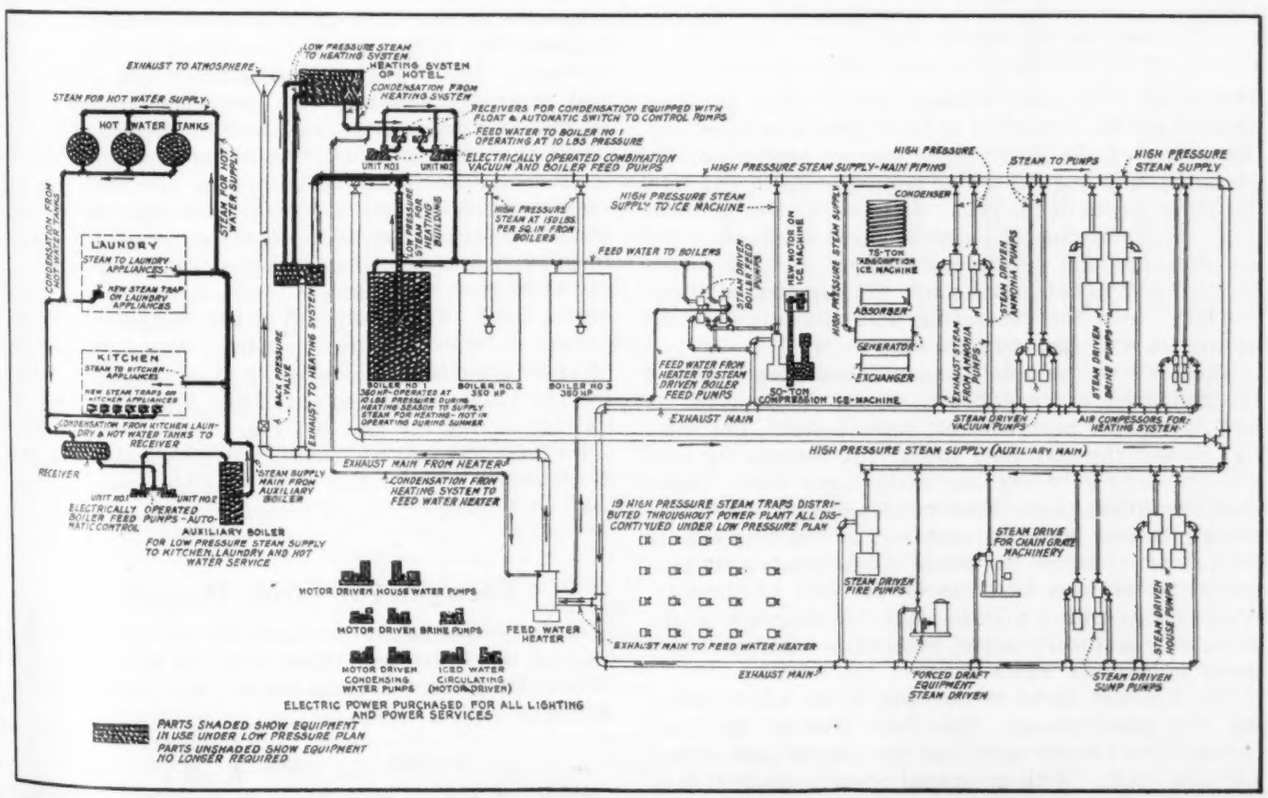

EXHAUST TO ATMOSPHERE
LOW PRESSURE STEAM TO HEATING SYSTEM
HEATING SYSTEM OF HOTEL
CONDENSATION FROM HEATING SYSTEM
STEAM FOR HOT WATER SUPPLY
HOT WATER TANKS
RECEIVERS FOR CONDENSATION EQUIPPED WITH FLOAT & AUTOMATIC SWITCH TO CONTROL PUMPS
FEED WATER TO BOILER NO 1 OPERATING AT 10 LBS PRESSURE
ELECTRICALLY OPERATED COMBINATION VACUUM AND BOILER FEED PUMPS
HIGH PRESSURE STEAM SUPPLY-MAIN PIPING
HIGH PRESSURE STEAM SUPPLY TO ICE MACHINE
HIGH PRESSURE STEAM AT 150 LBS PER SQ. IN. FROM BOILERS
FEED WATER TO BOILERS
LAUNDRY
STEAM TO LAUNDRY APPLIANCES
NEW STEAM TRAP ON LAUNDRY APPLIANCES
KITCHEN
STEAM TO KITCHEN APPLIANCES
NEW STEAM TRAPS ON KITCHEN APPLIANCES
CONDENSATION FROM KITCHEN LAUNDRY & HOT WATER TANKS TO RECEIVER
RECEIVER
ELECTRICALLY OPERATED BOILER FEED PUMPS-AUTOMATIC CONTROL
AUXILIARY BOILER FOR LOW PRESSURE STEAM SUPPLY TO KITCHEN, LAUNDRY AND HOT WATER SERVICE
BACK PRESSURE VALVE
EXHAUST TO HEATING SYSTEM
BOILER NO. 1 350 HP-OPERATED AT 10 LBS PRESSURE DURING HEATING SEASON TO SUPPLY STEAM FOR HEATING-NOT IN OPERATING DURING SUMMER
BOILER NO. 2 350 HP
BOILER NO. 3 350 HP
NEW MOTOR ON ICE MACHINE
HIGH PRESSURE STEAM SUPPLY
CONDENSER
150-TON ABSORPTION ICE MACHINE
ABSORBER
GENERATOR
EXCHANGER
STEAM TO PUMPS
HIGH PRESSURE STEAM SUPPLY
STEAM DRIVEN AMMONIA PUMPS
EXHAUST STEAM FROM AMMONIA PUMPS
STEAM DRIVEN BRINE PUMPS
FEED WATER FROM HEATER TO STEAM DRIVEN BOILER FEED PUMPS
50-TON COMPRESSION ICE-MACHINE
EXHAUST MAIN
STEAM DRIVEN VACUUM PUMPS
AIR COMPRESSORS FOR HEATING SYSTEM
HIGH PRESSURE STEAM SUPPLY (AUXILIARY MAIN)
EXHAUST MAIN FROM HEATERS
CONDENSATION FROM HEATING SYSTEM TO FEED WATER HEATER
STEAM SUPPLY MAIN FROM AUXILIARY BOILER
19 HIGH PRESSURE STEAM TRAPS DISTRIBUTED THROUGHOUT POWER PLANT ALL DISCONTINUED UNDER LOW PRESSURE PLAN
STEAM DRIVE FOR CHAIN GRATE MACHINERY
STEAM DRIVEN PIKE PUMPS
STEAM DRIVEN HOUSE PUMPS
MOTOR DRIVEN HOUSE WATER PUMPS
MOTOR DRIVEN BRINE PUMPS
FEED WATER HEATER
EXHAUST MAIN TO FEED WATER HEATER
MOTOR DRIVEN CONDENSING WATER PUMPS
ICED WATER CIRCULATING (MOTOR-DRIVEN)
EXHAUST MAIN
FORCED DRAFT EQUIPMENT STEAM DRIVEN
STEAM DRIVEN SUMP PUMPS
ELECTRIC POWER PURCHASED FOR ALL LIGHTING AND POWER SERVICES
PARTS SHADED SHOW EQUIPMENT IN USE UNDER LOW PRESSURE PLAN
PARTS UNSHADED SHOW EQUIPMENT NO LONGER REQUIRED

FIG. 2—SAVING IN SPACE WITH PURCHASED POWER AND LOW-PRESSURE HEATING

outline of the program followed in getting the load of the Brevoort Hotel of Chicago. The engineers of the contract department of the Commonwealth Edison Company first started work on this prospect in 1914. During the next few years a certain portion of the hotel load was obtained, but it was not until 1921, seven years after starting work, that the entire electric power and lighting load was obtained. During this period several investigations and reports were made to the hotel management by the power company and by the hotel's consulting engineer, Milton C. Hartman.

Complete statements of operating conditions and costs of power were prepared and the effect of purchased power on every element of the plant was then studied and the economies to be effected were tabulated. As a part of the study there was an analysis of the steam heating and hot water requirements of the hotel for every month of the year. Steps were made to determine the percentage of steam required for heating the building, and the percentage required for hot water, laundry and miscellaneous uses. The amount of steam available from the generating unit and miscellaneous apparatus was also determined.

TABLE II—SAVINGS WITH PURCHASED POWER, BREVOORT HOTEL, CHICAGO

	Operating Own Plant	Buying Power
Labor:		
1 chief engineer	$3,300.00	$3,300.00
1 assistant engineer	2,336.00	2,336.00
1 assistant engineer	2,336.00	2,336.00
1 assistant engineer	2,336.00	2,336.00
1 fireman	1,825.00	1,825.00
1 fireman	1,825.00	1,825.00
1 fireman	1,825.00	1,825.00
1 oiler	1,752.00	.....
1 oiler	1,752.00	.....
1 oiler	1,752.00	.....
1 coal passer	1,825.00	.....
1 electrician	2,204.80	2,204.80
Total labor	$25,068.80	$17,987.80
Coal	40,591.60	23,889.60
General Expense:		
Water bills	$2,527.10	$2,000.00
Hauling ashes	1,779.90	900.00
Gas bills	1,702.51	1,702.51
Engine room supplies	2,240.11	800.00
Boiler room supplies	725.13	480.00
Machinery repairs	1,519.97	900.00
Total general expense per year	$10,494.72	$6,702.51

Summary

	Operating Own Plant	Buying Power
Labor	$25,068.80	$15,651.80
Coal	40,591.60	23,889.60
General expenses	10,494.72	6,702.51
Power	.....	14,881.56
Total per year	$76,155.12	$63,461.47
Net annual saving with purchased power		$12,693.65

The tests of the hotel's consulting engineer showed the combined average hourly steam consumption to be 8,000 lb. per hour with all steam power. The same test showed the maximum steam requirements for heat and hot water to be less than 4,000 lb. per hour. Under these conditions, more than twice as much steam was being produced for power and heat as was required for heat alone; therefore the steam requiriments with purchased power were taken as 50 per cent of the total requirements with a private plant. A summary of the consulting engineer's report of savings with purchased power is given in Table II.

The Brevoort Hotel at the date of the above report had 325 guest rooms. The floor area of the hotel amounted to 148,000 sq.ft. and the cubical content was 1,580,000 cu.ft. With an annual power consumption of 945,000 kw.-hr. the hotel used 3,000 kw.-hr. per guest room per year and 0.6 kw.-hr. per cubic foot of volume.

Every hotel prospect presents a different problem and should be the subject of detailed study. At the same time there are certain conditions that obtain in all hotels that are worthy of consideration. In the opinion of Milton C. Hartman, consulting engineer for many metropolitan hotels throughout the country, every hotel should give favorable consideration to the possible savings to be made by purchasing all power during summer months and such power during the winter months as can profitably be used. The great number of facilities requiring power in the modern hotel make the exhaust steam available from a private plant greater than the demand for it in summer months. Likewise, in the opinion of Mr. Hartman, there will be periods of the day in winter months when the exhaust steam from generating units would be wasted. It would seem wise, therefore, for the hotel manager now operating his own plant to consider the use of purchased power during every hour of the year when the total exhaust-steam from a private plant could not be utilized.

CONTRACTING FOR SUMMER LOADS LEADS TO COMPLETE USE OF PURCHASED POWER

The Commonwealth Edison Company has always been willing to contract for the summer load of hotels, as it knows, from experience, that it will be only a matter of time until practically full use is made of its service. If the power company signs business on this basis, it will be in a position to take over the entire hotel load when the existing plant becomes obsolete or when extensive additions are made to the hotel and to its power load.

At the start, the obtaining of hotel power contracts was very difficult and business was signed only occasionally. As time went on one successful installation succeeded another and concrete evidence accumulated to show the advantages of purchased power. Hotel managers then began comparing notes and discovered that in many cases they had reduced operating costs as well as fixed charges and that in the case of new hotels they were able, by purchasing power, to utilize their capital to better advantage in the hotel proper than in the power plant. These managers also found themselves relieved of considerable responsibility when they eliminated the private plant and were able to devote more of their time to the main business of running a hotel. The final result of this campaign against private plants in hotels has been the adoption of central-station service by 93 per cent of Chicago's hotels and the failure of any hotel to build a private plant in Chicago during the past ten years.

On page 990 will be found illustrations showing five of Chicago's large hotels which purchase power from the Commonwealth Edison Company.

Formula for Circle Diagram

In the second column on page 902 of the October 31 issue of the ELECTRICAL WORLD, in the article entitled "Circle Diagram for Long Lines," the formula for β should be:

$$\beta = \tan^{-1}\frac{p}{\mu v} - \tan^{-1}\frac{K_2 \cos\delta}{K_1 \sin\delta}.$$

The symbol $\frac{\delta}{\partial}$ should not have appeared in this formula.

Good Business in Fixtures

More Than $160,000,000 Should Be Spent in Replacing Obsolete Fixtures in Homes—Of the Bulbs in Use 23 per Cent Are Unshaded and 31 per Cent of All Fixtures Are Obsolete—Possibilities Outlined

By M. LUCKIESH
Director Lighting Research Laboratory, Nela Park

IMPROVEMENT in residence lighting is not merely a dream of the idealist, for it is of vital interest to the commercial managers and executives of central stations. Such effort may have as a primary aim the conservation of vision and health of the users of electric light. It may also aim to bring the convenience and pleasure of adequate and proper lighting to the customers. Back of such effort may be the motive of profit, but even the increasing of residential consumption, attractive as this may be, is outranked in importance by an effect which tends to pyramid the result. The greatest achievement of improved residence lighting is the resultant change in attitude of the user toward artificial lighting.

At present there is a vast indifference toward the possibilities and even the advantage of adequate and proper lighting. Worse still, artificial lighting is viewed by many persons as a necessary evil or as a poor substitute for daylight. This unfavorable attitude arises from the misuse of light; from ignorance of its ability to introduce comfort, cheer and charm into the home; and from false ideas as to its cost and value relative to other essentials and to even non-essentials. With the exception of the air we breathe, artificial light is the cheapest essential that we encounter in our homes. Properly presented and demonstrated, artificial lighting is very easy to sell.

Many things must be done before residence lighting is generally proper, adequate and charming, but one of the most vulnerable points of attack is in the replacement of obsolete fixtures. The problems of selling and of installing an outlet do not exist, for the outlets are awaiting the fixture installer. The householder is not confronted with a messy job and the installation is made in a short time. Surely the replacement of obsolete fixtures chiefly involves the sale of a new article to replace an antiquated one. The furniture dealer and others are doing a similar job all the time.

THE PERCENTAGE OF OBSOLETE FIXTURES

Previous articles have indicated that the number of fixtures in the average home is far from adequate for proper lighting. However, quite aside from these additional fixtures which are necessary (and also the additional outlets to accommodate them) a very large percentage of the fixtures now existing in homes are obsolete. The percentage is still greater if we include all unsatisfactory fixtures. According to our survey conducted three years ago, about 50 per cent of the fixtures existing in wired homes are obsolete or need to be rehabilitated by providing them with shades or with better glassware. Narrowing this down to obsolete fixtures of the types illustrated in Fig. 1, we find that 31 per cent of all existing ceiling fixtures, exclusive of attic, closets, basement and exterior, are unquestionably obsolete. Such data, which became available for the first time about three years ago,[1] has done much to stimulate the development of residence wiring and lighting.

One might also include many modern fixtures in the obsolete class, for unshaded fixtures should be considered obsolete. Furthermore, many modern fixtures are copied from archæological objects so old as to be quite obsolete in lighting principles in this present age of inexpensive controllable light.

SURVEY DATA STIMULATE CAMPAIGNS

Let us see how these survey data may be used. For example, the first survey revealed the fact that 71 per cent of the ceiling fixtures in kitchens were unques-

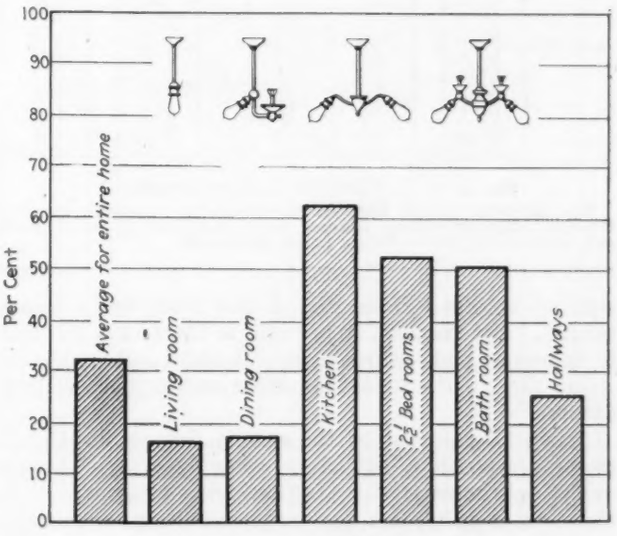


FIG. 1—OBSOLETE FIXTURES ABOUND

The percentages of the total ceiling fixtures in various rooms and in the entire home which are unquestionably obsolete as indicated in the sketches. These results apply only to the rooms indicated and not to basement, attic and closets, where, for example, drop-cords may be satisfactory.

tionably obsolete and that these contained an average of 59 watts. Obviously, about three out of four homes were prospects for a modern kitchen unit. Furthermore, by installing a 100-watt lamp the wattage was increased 70 per cent and by installing a 150-watt daylight lamp the wattage was increased 154 per cent. It was seen in the first article of this series that the average net revenue per consumer was doubled for a certain central station in the first case and trebled in the second case. The average increase in net

[1] M. Luckiesh, *Proc.*, N. E. L. A., Vol. 79, 1923, p. 598. See also report on Residence Lighting, Lighting Committee, N. E. L. A., 1925.

revenue per consumer as reported by 106 companies was about 50 per cent.

In Fig. 1 it is seen that at the present time 63 per cent of the ceiling fixtures in kitchens are unquestionably obsolete. The average watts per fixture is now about 63. Therefore the possibilities in refixturing in kitchens are still very great. Kitchen campaigns have many years to run.

Many other data pertaining to refixturing campaigns

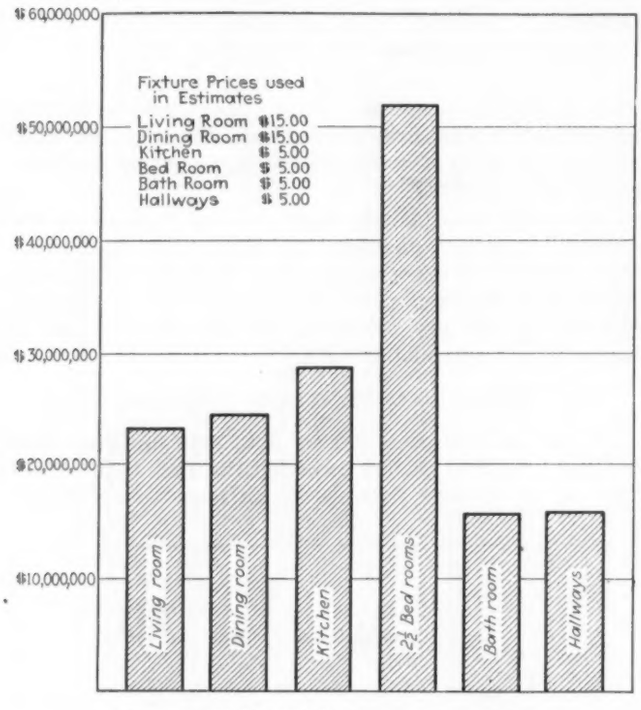


FIG. 2—A $160,000,000 FIXTURE BUSINESS

The potential fixture business obtainable by replacing unquestionably obsolete ceiling fixtures in present wired homes with new fixtures at the moderate prices indicated.

may be obtained from Fig. 1 and from the original reports. For example, 50 per cent of the ceiling fixtures in bedrooms and bathrooms are obsolete, although only about three out of four of these rooms have ceiling fixtures.

About 18 per cent of the ceiling fixtures in dining rooms are obsolete, but many other fixtures in dining rooms are unsatisfactory. Therefore it appears that there are possibilities for commercializing a suitable dining room fixture which is satisfactory from both lighting and artistic viewpoints.

Many kitchen-unit campaigns have been successfully conducted and these will become a permanent activity of the central station and of other interests. Dining room campaigns are being tried out. More elaborate refixturing campaigns have either been begun or are under consideration. The Ohio Public Service Company offered in groups fixtures for kitchen, dining room, living room and bedroom at a group price.

FIXTURE BUSINESS AVAILABLE

The obsolete fixtures provide a potential market for new fixtures at all times, whether wiring and building are going on or not. The replacement of these may interest the central station primarily from the viewpoint of energy consumption. Usually by selecting a proper fixture, the connected load may be increased, and often very greatly. However, even when the connected load is not increased, there is usually a greater energy consumption owing to the longer period of operation of a satisfactory fixture.

There are the dealers and manufacturers who are interested in the sales of fixtures. A glimpse of the business obtainable is presented in Fig. 2 in replacing the obsolete fixtures illustrated in Fig. 1 with new fixtures at the moderate prices indicated in Fig. 2. At these very low prices there is a business of $162,000,000 awaiting those who go after it. If we increase these prices and include the many unsatisfactory fixtures, this figure is greatly increased.

In a city of 100,000 inhabitants, kitchen units to the value of at least $100,000 must be sold in order to replace the obsolete ceiling fixtures in the kitchens. At a price of $15 per fixture, fixtures to the value of $60,000 must be sold to replace the obsolete ones in the dining room. At very moderate prices about $400,000 of new fixtures must be sold in this city to replace the unquestionably obsolete fixtures in the homes. In fact, it seems safe to assume that at least a million dollars' worth of refixturing business awaits in plain view in the homes in any city composed of 100,000 inhabitants.

BULBS WITHOUT SHADES

It has been found that 23 per cent of the lamp bulbs in homes are unshaded. These must be equipped with shades before the lighting is comfortable and satisfactory and therefore before the householder can be expected to become a booster for artificial light. In the age of candles the feeble flames were not bright enough to be harmful, but the condition has radically changed. Now we have high brilliancy as an accompaniment of higher luminous efficiency. Lamp bulbs even when frosted should be shaded for eye comfort and pleasing effects. Actual shades for unshaded bulbs must be sold in addition to selling the idea of shaded light. To equip the unshaded lamp bulbs in the homes with suitable shades there is an average business available equivalent to about one dollar per inhabitant in places where a high percentage of the homes are now wired.

Argentine Central Stations Grow

THE Compañia Hispano-Americana de Electricidad of Buenos Aires increased the number of its customers during 1924 from about 160,000 to 184,628, with a connected load of 530,181 kw. Extensive additions to equipment, including one 25,000-kw. unit installed and two similar units to be installed this year, have been necessary and will raise the capacity of the modern plant to 125,000 kw. A healthy growth in customers served by some of the company's subsidiaries operating in the outskirts of Buenos Aires has led to plans for a power station with an initial capacity of 125,000 kw., to be ready in 1928, and an ultimate capacity of 500,000 kw.

The Société d'Electricité de Rosario also reports an increase from 29,910 customers to 33,627 customers with a decrease in operating costs due to favorable fuel prices.

The Compañia Hispano-Americana is steadily extending its territory and absorbing smaller companies, while the Sociedad Emprese de Luz y Fuerza de Mendoza expects to complete a 12,000-hp. hydro-electric development on the Mendoza River in 1926.

Increased Voltages for General Supply of Light and Power*

Past Practice Hampered by the Shortsightedness as to Load Growth—The Advantages of 4,600-Volt Service—An Example of Its Successful Adoption on Connecticut Light & Power System

By J. E. KING
Distribution Engineer Connecticut Light & Power Company, Waterbury, Conn.

INCREASING demand on central stations for the supply of additional electric service and its extension into new territories is fast becoming one of our greatest problems. Since there is no reason to believe that these demands will lessen with the passing of time, but rather that they will become more and more insistent as a universal desire for electric service grows, the industry is faced with the necessity of making comprehensive changes and enlargements of plant. It would appear in many cases that past practices have been somewhat shortsighted, in that present systems have not been laid out with sufficient anticipation of the ultimate growth and possible extension of service. The result is that facilities have been loaded and extended to such a point that service is seriously affected, further increase will find the systems entirely inadequate, and we are confronted with the necessity for major changes as the only cure.

This is the point at which most utilities find themselves today, and in order to prevent, in so far as possible, a recurrence of this condition, we, as operators, are endeavoring to study carefully the characteristics and prospects of the territories in which we operate, with a view to anticipating ultimate requirements more accurately and providing for them, so that henceforth we may be able to proceed in accordance with well-devised plans in carrying on programs of work, in order that we may ultimately and economically attain the desired end.

Fig. 1 shows a generating station, designated as No. 1, supplying light and power service to a city and its surroundings. Usually such a station is advantageously located as a distributing station and represents an investment of considerable size. The generators, station equipment, distribution systems and other facilities have been designed to operate at 2,300 volts, three-phase and single-phase. The feeders and equipment have been enlarged, reinforced, loaded and extended, until they are no longer adequate to meet further increases of demand or extensions to remote territories at 2,300 volts. Shall we further enlarge the generating station and its distribution facilities? In many cases such procedure would be inconsistent with a logical plan of development, or the property available may be too small to permit of further expansion as a generating station. Shall we abandon the old plant, together with its useful distribution facilities? Unfortunately the very heavy investment represented in the system, coupled with the fact that there still remains a considerable amount of useful life in it, makes it unfeasible to abandon it at once and write it off. What is to be done?

In a problem of this type there are several elements to consider in searching for a correct solution. Adequate, dependable service, which can be further expanded, is one of the most important of these, so that

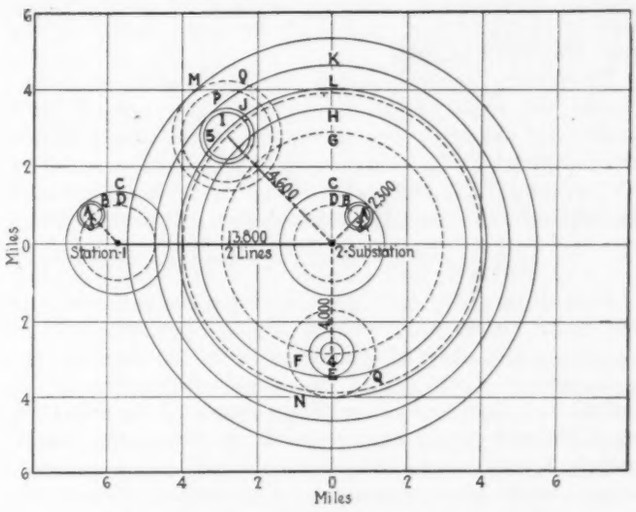


FIG. 1—COMPARISON OF DISTRIBUTION AREAS FOR VARIOUS ELECTRICAL CONDITIONS

we should avoid a system which will allow a recurrence of our present difficulties. Efficiency and economy are other factors which must also be carefully borne in mind. With these considerations before us, we turn quite naturally to higher voltages as a means of obtaining better service and increased capacity, greater efficiency of distribution and greater economy of operation through considerably reduced losses.

The solution of the problem appears to be along the line of supplementing the capacity of the generating station with transmitted power. The next step appears to be to establish suitable substations, as at 2, carefully selecting the sites with regard to load centers and future development. These substations could be supplied from No. 1 through duplicate high-voltage supply lines, extending from 1 to 2. Such supply lines should be utilized to the greatest possible extent for supplying large blocks of power direct to industrial corporations en route. By this means a considerable decrease in total investment results, a higher load factor for the line is attained, and the earning power of the investment is increased.

*Presented at a recent management and operating conference of the United Gas Improvement Company and Associate Companies in Philadelphia.

Once these distributing substations have been properly located and established at points advantageous for the supply of present and future loads, and a well-planned power supply has been provided, we are confronted with the moot question: "At what voltage shall we redistribute from these substations so as not to find ourselves, in a few years, in a condition similar to the one now facing us?" There appears to exist a great difference of opinion as to what voltage and kind of system should be used for the lower-voltage primary distribution. In considering this phase of the problem there are certain limitations which in a way govern the type of system we may select. We are looking for a system that possesses great flexibility—one that will increase the capacity of the whole system, single-phase as well as three-phase, in order to provide good service on remote extensions where the revenue derived does not justify the expense of three-phase. Another factor that must be contended with in primary distribution systems is the attitude of the communication companies, which, in general, occupy nearly all of the highways with their facilities. Since they object at present to the extensive establishment of joint lines where open-wire circuits operating in excess of 5,000 volts are employed, this value appears to mark the upper limit of the voltage that may be used.

Frequently central-station operators attempt to increase the capacity of old systems and extend their radius by changing the 2,300-volt, three-phase, three-wire system to a 2,300/4,000-volt, three-phase, four-wire "Y" system. Let us consider whether such a four-wire system offers a satisfactory solution of our problem.

ADEQUACY OF 4,600-VOLT PRIMARIES

Referring again to Fig. 1, one notes a difference in the distribution radii of the various systems. Thus, assuming the same size conductors in the feeders, the same power factors, and the same loads delivered at points 3, 4 and 5, representing centers of distribution, the 2,300-volt feeder has an operating radius of approximately 1.0 mile, and the 4,000-volt feeder has an operating radius of approximately 2.99 miles; whereas the 4,600-volt feeder has an operating radius of approximately 4 miles; the voltage drop in each case being 10 per cent, which it is assumed will be compensated for by means of feeder regulators. The circles *A*, *E* and *P* indicate the respective areas that can be served by each system when equal numbers of No. 6 single-phase mains per 800-kva. circuit are used to distribute the total load from the centers of distribution 3, 4 and 5, and the drop is not allowed to exceed 3 per cent. The circles *B*, *Q* and *O* indicate the respective territories that can be served by three-phase mains under similar conditions. From the tabulation on the chart, one sees that the number of three-phase mains required per circuit to distribute the 800 kva. in each case from points 3, 4 and 5, representing centers of distribution supplied by 2,300-volt, 4,000-volt and 4,600-volt feeders respectively, is four, and the number of single-phase mains required is six.

It will also be seen that, assuming as before, there are an equal number of mains per 800-kva. circuit, the distribution possibilities of the various three-phase systems are represented by the areas inclosed in circle *M* for the 4,600-volt system, in circle *N* for the 4,000-volt system and in circle *C* for the 2,300-volt system.

If, however, the same current density of 60 amp. per conductor is maintained in the mains for each system and the number of mains is allowed to vary, the distribution possibilities of the various systems are represented by circles having radii equal to *A*-2 for the 2,300-volt, *E*-2 for the 4,000-volt and *I*-2 for the 4,600-volt, single-phase; or *C*-2 for the 2,300-volt, *H*-2 for the 4,000-volt and *K*-2 for the 4,600,volt, three-phase systems.

On the chart Fig. 2 it is interesting to note the relative weights of conductor required for the various systems. Assuming, in each case, the same load, length and power loss, and assuming the 2,300-volt, single-phase system as a base, or 100 per cent, by comparison the 2,300-volt, three-phase, three-wire system requires but 75 per cent of the copper, and the 4,000-volt, three-phase, four-wire system but 33 per cent of the copper; whereas the 4,600-volt, three-phase, three-wire system requires but 18.75 per cent of the copper. Referring to the I^2R line loss, assuming the same load, length and size conductor in each case, and assuming the 2,300-volt, single-phase as a base, or 100 per cent, we see that the 2,300-volt, three-phase, three-wire system has a power loss of 50 per cent, and the 4,000-volt, three-phase, four-wire system a power loss of 16½ per cent; whereas the 4,600-volt, three-phase, three-wire system has a power loss of but 12½ per cent. The relative area that can be served, assuming the same load, power loss and weight of conductor in each case, assuming the 2,300-volt, single-phase system as the base, or 1, is 1.78 for the 2,300-volt, three-phase, three-wire system, and for the 4,000-volt, three-phase, four-wire system the area is 9.0 units; whereas for the 4,600-volt, three-phase, three-wire system, the area that can be served is 16.0 units.

The relative voltage regulation in per cent of the various systems, assuming the same load, length and size of conductor in each case, and assuming the 2,300-volt, single-phase system as 10 per cent, is, for the 2,300-volt, three-phase, three-wire, 5 per cent, and for the 4,000-volt, three-phase, four-wire, 1.66 per cent; whereas for the 4,600-volt, three-phase, three-wire, the regulation is but 1.25 per cent. Assuming the same power loss, length and size of conductors, and assuming the 2,300-volt, single-phase system as 1, the relative capacity for the 2,300-volt, three-phase, three-wire system is 1.732, and for the 4,000-volt, three-phase, four-wire system the relative capacity is 5.23; whereas for the 4,600-volt, three-phase, three-wire system, the relative capacity is 6.93.

It is obvious that the 4,600-volt primary distribution is logical from almost every point of view, unless the ultimate capacities or the eventual territorial limits do not make necessary the employment of a voltage higher than 2,300. In these days, however, in other than sparsely settled, confined communities, it is unusual to find a condition of this sort.

4,000-VOLT, FOUR-WIRE Y A PALLIATIVE ONLY

In medium-sized and in large, fast-growing communities, if the 4,000-volt, three-phase, four-wire Y scheme of distribution is resorted to, it usually involves major changes and expenditures, which has a tendency only to prolong the day when a complete departure becomes an absolute necessity, because the increased capacities gained by going to 4,000 volts, Y, over and above that provided by 2,300 volts delta, and the ability to increase the radius of operation, especially where single-phase is involved, in most cases are not great enough. In contrast with this, if the distributing substation plan

is followed out as indicated on the chart and the higher supply voltages are employed, utilizing 4,600 volts, three-phase, for primary distribution, there is no limit to the amount of expansion, including load increases and extension of facilities, that can be attained.

One of the main reasons often advanced by operating companies that have seen fit to change their distribution system to 4,000 volts, four-wire Y, is that they are enabled to keep in service transformers and other equipment that they have on hand. This is hardly a compelling reason, because such equipment as may be involved can in most cases be utilized on the original

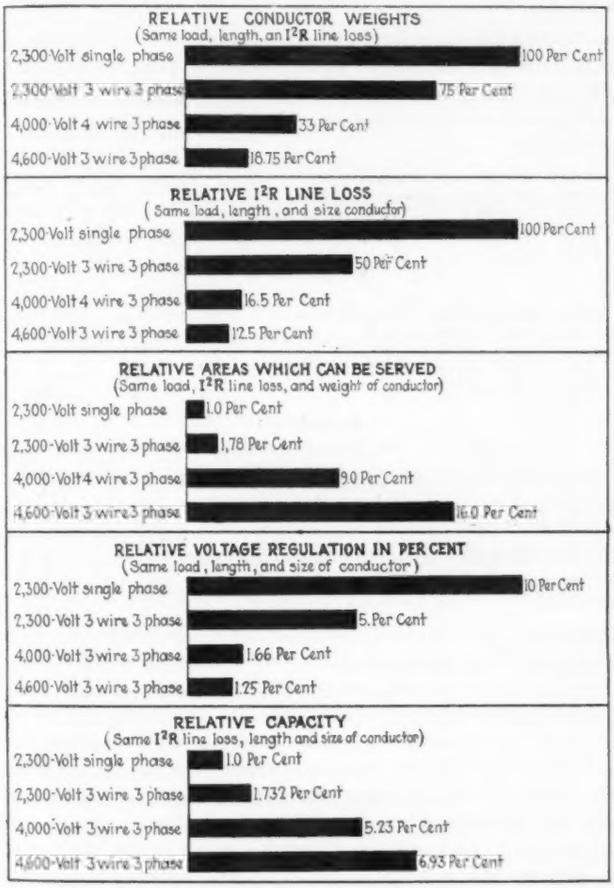

RELATIVE CONDUCTOR WEIGHTS
(Same load, length, an I²R line loss)
2,300-Volt single phase
100 Per Cent
2,300-Volt 3 wire 3 phase
75 Per Cent
4,000-Volt 4 wire 3 phase
33 Per Cent
4,600-Volt 3 wire 3 phase
18.75 Per Cent
RELATIVE I²R LINE LOSS
(Same load, length, and size conductor)
2,300-Volt single phase
100 Per Cent
2,300-Volt 3 wire 3 phase
50 Per Cent
4,000-Volt 4 wire 3 phase
16.5 Per Cent
4,600-Volt 3 wire 3 phase
12.5 Per Cent
RELATIVE AREAS WHICH CAN BE SERVED
(Same load, I²R line loss, and weight of conductor)
2,300-Volt single phase
1.0 Per Cent
2,300-Volt 3 wire 3 phase
1.78 Per Cent
4,000-Volt 4 wire 3 phase
9.0 Per Cent
4,600-Volt 3 wire 3 phase
16.0 Per Cent
RELATIVE VOLTAGE REGULATION IN PER CENT
(Same load, length, and size of conductor)
2,300-Volt single phase
10 Per Cent
2,300-Volt 3 wire 3 phase
5. Per Cent
4,000-Volt 3 wire 3 phase
1.66 Per Cent
4,600-Volt 3 wire 3 phase
1.25 Per Cent
RELATIVE CAPACITY
(Same I²R line loss, length and size of conductor)
2,300-Volt single phase
1.0 Per Cent
2,300-Volt 3 wire 3 phase
1.732 Per Cent
4,000-Volt 3 wire 3 phase
5.23 Per Cent
4,600-Volt 3 wire 3 phase
6.93 Per Cent

FIG. 2—COMPARATIVE ECONOMIC DATA FOR VARIOUS DISTRIBUTION SYSTEMS

system without alteration except that the radius of operation of the original system becomes shorter as the load increases or concentrates on the original 2,300-volt feeders emerging from the generating station, or it can be advantageously used on the distribution systems of small, confined communities where voltages higher than 2,300 are not required. Shortening the radius of operation of the original lines and leaving them and their present equipment to supply the more concentrated loads at points not far remote from the original distribution station or substation, together with the continued use of 2,300-volt distribution for the remote, confined localities, permits utilizing the old equipment and the investment it represents to the end of its useful life, thereby eliminating the necessity of prematurely amortizing the investments represented. As the radius of operation of these original lines decreases and as the load on them becomes more concentrated, the ends, with their loads, which we might assume extend into the area inclosed by arcs of circles *C* and *M*, can be cut to the 4,600-volt distribution system supplied from the next adjacent substation.

One objection to the three-phase, four-wire, 4,000-volt primary distribution system which is inapplicable to the three-phase, three-wire, 4,600-volt system is that pole line facilities will not always permit of the fourth wire being erected where necessary, without a considerable amount of reconstruction, which, of course, runs up the costs.

Also, if the 4,000-volt system is to be extended from the original generating station, displacing the 2,300-volt lines and equipment, the generating equipment itself usually must be extensively altered to provide for the change, or else a transformer bank equal in capacity to that of the whole system must be installed. Furthermore, if 2,300-volt transformers are to be used on single-phase extensions, the four-wire system provides no relief whatever for overload single-phase extensions, because there is no gain in capacity or ability to extend farther, over the original instance of 2,300 volts. Where neutrals are grounded, as is usually the case on systems of this kind, interference with communication service is often claimed. Such deliberate grounding of the neutral certainly does not decrease the liability of line wires to burn down where they foul trees or other grounded obstructions.

Economical Provision for the Future Growth of Load

Therefore, in view of these objections and of the facts brought out on the charts, it would appear that resorting to other than the higher voltage supply lines routed for the combined supply of large blocks of power and of distributing substations, which have been advantageously located with the future in mind, and distributing from these substations at other than 4,600 volts, three-phase, three-wire, in order to increase the capacity and radius of operation of a 2,300-volt, three-phase, three-wire system or a 2,300-volt, two-phase, four-wire system, is logically incorrect, as any other scheme is limited in its possibilities; and should service requirements continue to increase, eventually the plan referred to and shown on the chart, in each case modified to suit conditions, must be resorted to. If this is not done and loads continue to increase and long extensions are demanded, the ultimate result will be to some extent a duplication of expenditures to attain the one end, because the larger consumers, on account of the capacity involved, must be supplied from the higher voltage lines, and these investments can usually be used to a great degree in supplying, with less loss and duplication, all the service in localities to which, or through which, they extend.

In most systems careful studies of load possibilities and facilities in service probably will indicate that in the not distant future increased capacity will be required. With this information, which we all should have before us, if we are to keep in close touch with conditions, it is possible in day-to-day maintenance and extension work to make suitable provision for high-voltage supply lines to future substations and for redistribution at 4,600 volts, selecting routes, performing pole line work, trimming trees, etc., to insure a proper development for each locality. Twenty-three-hundred-volt equipment encountered in such maintenance work on distribution lines that will eventually be operated at

4,600 volts in order properly to supply the territories might well be replaced with 2,300/4,600-volt equipment, utilizing the displaced equipment on lines that will continue to operate indefinitely at 2,300 volts, as previously mentioned. Such procedure has a tendency to eliminate the necessity for extensive and costly major changes being made at one time in order to care properly for the increased service demanded.

EXPERIENCE IN CONNECTICUT WITH 4,600 VOLTS

An outline of the transmission and distribution system of the Connecticut Light & Power Company may serve to illustrate a practical application of the foregoing plan. Energy from several steam and hydroelectric stations is stepped up to 66,000 volts for transmission to various district substations. Line equipment was installed, bearing in mind possible future increase in transmission voltage. At the district substations, the pressure is stepped down to 27,600 volts or 13,800 volts for the supply of large power consumers and distributing substations, and to 4,600 volts at the new substations for their primary distribution or to 2,300 volts at the old original stations and substations, for adjacent local distribution. The 27,600/13,800 supply voltages were selected because they are standard for distribution service and do not require too cumbersome line equipment and construction when routed through city streets. A voltage of 13,800 is used for the supply of moderate loads, or on lines that pass through densely populated areas, whereas on long runs and in open territory the higher supply voltage is frequently employed. Where the future load may be too great to keep the maximum line drop under 10 per cent, lines and equipment now operated at 13,800 volts have been designed for ultimate operation at 27,600 volts, the transformers having 27,600/13,800-volt double-ratio windings. When conflicts with other utilities and safety considerations require, either aërial or underground three-conductor cable is employed, as conditions dictate.

USE OF VARIOUS VOLTAGE TAPS TO CONTROL RECEIVER VOLTAGE

Receiver voltage values are controlled on these lines by using transformers having two 5 per cent taps in addition to the normal voltage tap. Assuming the bus voltage maintained at 13,800, compensation for line drop at full load is obtained by using the 5 per cent 13,110-volt tap or the 10 per cent 12,420-volt tap, depending on the distance the consumer is from the station and upon the loading of the line. Since the maximum drop at the remote end of the line is never allowed to exceed 10 per cent, full-load voltage to the consumer is kept approximately normal, and should there be an absolute no-load period, the no-load voltage is within 10 per cent plus. If conditions at a receiving point make a minus voltage departure desirable at full-load periods, the next higher tap is used.

As stated, distributing substations are supplied from the 27,600/13,800-volt systems. These substations, accessibly located and adjacent to present and prospective load centers, redistribute at 4,600 volts or 2,300 volts.

Some districts are now operating a majority of their primaries at 4,600 volts, while others are in the process of raising the voltage of certain circuits. As transformers are replaced in routine work to provide additional capacity, or as they are shifted in accordance with the results of periodic secondary surveys, or as circuits for other reasons are rebuilt and rearranged, new double-ratio transformers are set. The old ones are either utilized on the circuits that are to remain at 2,300 volts, or are shipped to districts that include sparsely settled, confined communities of limited area, through which our higher voltage supply or transmission lines pass, where they are utilized, together with displaced 2,300-volt regulators and other equipment, being supplied through step-down transformers from the higher voltage lines. Wilton, Cannondale, Georgetown, Berlin, East Berlin, Kensington and Middlebury represent such communities. Here the nature of the territory makes it improbable that voltages higher than

COMPARATIVE OPERATING RADII FOR THE VARIOUS SYSTEMS

3 per Cent Regulation, Assuming 80 per Cent P. F.—All Feeders Regulated, Using 2/0 Conductors in Feeders and No. 6 Conductors in Mains, Limiting Voltage Drop in Feeders to 10 per Cent and Drop in Mains to 3 per Cent.

		Balanced 3 Phase			Single Phase		
Voltage	Kva. Delivered	Mains Required	Radius	Miles	Mains Required	Radius	Miles
2,300	800	4	C–2	1.33	6	A–2	1.28
4,000	800	4	N–2	4.13	6	E–2	3.27
4,600	800	4	M–2	5.32	6	P–2	5.12

Feeder Radii

Radius	Miles	Voltage	Phase	Size Conductor	Per Cent P.F.	Per Cent Drop	Kva. Delivered
1–3	1.00	2,300	3	2/0	80	10	800
2–3	1.00	2,300	3	2/0	80	10	800
2–4	2.99	4,000	3	2/0	80	10	800
2–5	4.00	4,600	3	2/0	80	10	800
1–2	5.70	13,800	3	2/0	80	7	6000 (2 lines)

Main Radii

Radius	Miles	Voltage	Amps.	Phase	Size Conductor	Per Cent P.F.	Per Cent Drop	Delivered	Supplied	Required
A–3	0.28	2,300	60	1	6	80	3	800	A	5.8 or 6
E–4	0.28	4,000	60	1	6	80	3	800	E	5.8 or 6
I–5	0.56	4,600	60	1	6	80	3	800	I	2.9 or 3
B–3	0.33	2,300	60	3	6	80	3	800	B	3.35 or 4
F–4	0.57	4,000	60	3	6	80	3	800	F	1.93 or 2
J–5	0.66	4,600	60	3	6	80	3	800	J	1.68 or 2

2,300 will ever have to be resorted to, but even in such cases the step-down bank is provided with 2,300/4,600-volt windings in order to meet any contingencies. Line construction, whether for 2,300-volt or 4,600-volt operation, is not altered, as this work is standardized for all lines and all districts regardless of which voltage is employed. Line drop in primaries is compensated for by means of feeder regulators. When additional regulators are purchased, 4,600-volt or 4,600/2,300-volt windings are specified.

This type of transmission and distribution system was adopted by the Connecticut Light & Power Company about six years ago, after a study and survey of the various systems operated by the company indicated that it was becoming necessary to establish additional distribution points and either add to the capacity of the 2,300-volt lines and equipment or increase the voltage of the systems. After the last was chosen, an effort was made, in carrying on day-to-day maintenance and extension work, to provide, in so far as was justifiable, for such changes. Since then many new distribution points have been established, and a large part of the distribution systems have been changed to 4,600 volts. The preliminary work that was done from time to time proved very beneficial and, we believe, economical, as very little overtime work was involved, interruptions to permit making of final changes were of exceptionally short duration, and by gradually bringing about the conditions necessary for the changes in voltage, confusion and mistakes were absent.

Electric Heating in Combination Gas and Electric Utilities

Consideration of the Customer's Best Interest Paramount—Settling "Gas vs. Electric" Disputes "Out of Court"

An Interview with
JOHN G. LEARNED
Vice-President Public Service Company of Northern Illinois

ONE OF the serious problems in developing the industrial electric heating load is the policy that a combination electric and gas utility should adopt in its recommendations to customers as to the kind of heat, either electric or gas, to use for industrial processes. This question has developed a highly competitive situation between electric and gas sales engineers that is often intensified when both services are rendered by the same company but sales work is carried on by two separate departments. To determine how a representative utility supplying both gas and electric services in a well-diversified industrial territory handles this problem, the ELECTRICAL WORLD has asked John G. Learned, vice-president in charge of sales of the Public Service Company of Northern Illinois, to outline his company's policy and practices in this respect. His reply, which is quoted here, is based upon the sound principle of the utility's rendering its customers the maximum degree of service commensurate with low cost and quality of results. Mr. Learned said:

"The customer's best interest should be the foremost consideration of a combination gas and electric utility when developing industrial gas and electric heating. Sound business policy demands that a question involving the customer's satisfaction and profit from the use of the company's service must be decided upon the basis of greatest service to the customer. On questions of gas versus electricity for an industrial heating application the deciding factor is customer benefit and not company expediency.

"For example, assume you are operating a utility supplying both gas and electric service in a community where an important industrial heating prospect is located. Assume further that adequate gas service is available at the customer's premises and that the extension of electric service sufficient for the proposed load would involve a considerable capital expenditure by the utility. Now, a careful analysis of the customer's needs and the value of company's service in terms of finished product, as reported by the utility's sales engineers for gas and for electricity, shows a balance in favor of electric heat. In such a case, expediency would urge the utility to sell the customer gas service, thereby obtaining a material increase in gross earnings with no additional capital expenditure. Good business, however, would dictate that if electric heat would enable the customer to turn out a better product at lower cost than would be possible with gas service, the utility must decide on the basis of value to the customer and sell electric heat."

Although believing that certain distinct fields of heat application are best suited to gas and others best suited to electricity, Mr. Learned also believes that there are many so-called "border-line" applications where accurate determination of the best medium for the customer's needs is difficult. The latter situations arise where the gas and electric sales engineers cannot agree on what is best for the customer. Such cases, Mr. Learned insists, should be decided only after full consideration by the new-business department staff, and consideration of the customer's best interest may sometimes point to the wisdom of consulting with competent authorities outside the utility organization.

"Precedent and executive judgment should be brought to bear on all 'border-line' applications," said Mr. Learned. "This again is good business, because it avoids disputes on the relative merits of gas and electricity by company representatives in the presence of the customer. Such disputes can only be futile, as they create in the mind of the prospect distrust of both gas and electricity and when the smoke has cleared away the prospect will be found using other fuel. When the doctors disagree, the patient may decide to write his own prescription.

"This policy of settling disputes on 'gas vs. electricity' 'out of court' might well be followed where separate utilities supply gas and electricity. The best interest of the customer is quite as important in this situation as when both services are supplied by one utility. This does not mean that aggressive sales effort should not be made to develop both gas and electric industrial heating, because the possibilities for both industrial gas and industrial electric heating are so great that there is ample room for both, but it does mean that gas and electric utilities, whether supplying one or both services, cannot afford to neglect the real interest of the customer. Here, too, it is possible for the utility furnishing the less favored service for a particular application to capitalize the loss of business to the other heating medium, because in some other locality this company may be able to furnish the preferred service."

SALES RESISTANCE TO INDUSTRIAL HEATING

"What constitutes the greatest sales resistance to industrial heating?" Mr. Learned was asked.

"Human inertia, or unwillingness to change from existing methods of operation and unwillingness to make the capital outlay required. The first factor is the more important and issues the greatest challenge to real salesmanship. The second factor, capital outlay required, may in certain cases be handled to advantage by the utility adding the cost of the new equipment to the power bill, or in other ways enabling the department charged with the furnace to pay for it over a period of a year rather than concentrating the entire cost in one or two months. Industrial electric heating is in a stage today comparable with that of electric power a number of years ago. Certain sound practices followed in developing electric power loads at that time should not be without merit today, bearing in mind the more expensive, more complicated and more specially designed character of industrial heating apparatus compared with the electric motor."

Asked what type of sales representative should be used by central stations in developing industrial heating, Mr. Learned's answer was: "An industrial heating sales engineer must 'know his book.' He must know just a little more about any particular heat application than the prospect himself. He must be able to determine to a large degree the exact requirements of the prospect. This knowledge of the customer's needs can come only from adequate training, the power of observation and a willingness to work. Add to these qualities a keen sense of salesmanship, and you have a heating specialist that gets results."

Industrial Load of North Central States

Illinois Leads the Twelve Commonwealths in Extent of Electrification with 72 per Cent—2,816 Private Generating Plants—Central Stations Supply 58 per Cent of Energy Consumed

THAT the manufacturing plants in the North Central States are 64 per cent electrified and that the central stations furnish 58 per cent of the energy consumed by them are the two outstanding facts indicated by an industrial survey just completed by the ELECTRICAL WORLD as part of its nation-wide investigation. Summarized data on the use of electrical energy by the various industries of this section will be found in the accompanying tabulation. Lack of space makes it impossible to publish the detailed state data in these columns, but the state figures have been issued in pamphlet form and will be sent to any one upon request. A detailed analysis of the industrial load of the New England and the Middle Atlantic States appeared in the issues of September 12 and October 10, 1925, respectively, and detailed data on the individual states in those sections of the country are also available upon application.

The rating of the power machinery installed in the manufacturing establishments of the North Central States is greater than that reported for any other section of the nation—10,819,210 hp. Almost 85 per cent of this total primary power is concentrated in the five industrial states of Illinois, Indiana, Michigan, Ohio, and Wisconsin. Based upon the returns received in the survey, the estimate is made that 2,311,227 hp. of this total power is installed in private electric generating plants and that 4,613,377 hp. is in electric motors which are run by energy purchased from central-station lines. Using these figures as a basis, it is estimated that industry as a whole in the North Central States is now 64.0 per cent electrified. This is a high degree of electrification compared with other industrial sections of the country, the New England States and the Middle Atlantic States reporting 58.2 per cent and 59.6 per cent electrification respectively.

The North Central States report 2,816 private industrial electric generating plants, by far the greatest number reported by any section of the country. The private plants have a total generator rating of 2,141,601 kva. and during 1924 generated a total of 4,501,535,000 kw.-hr. In addition to this consumption of privately generated energy, the individual plants of this section purchased 6,151,506,000 kw.-hr. from central-station companies, making a total energy consumption during 1924 of 10,653,041,000 kw.-hr., of which 57.8 per cent was purchased from central-station lines and 42.2 per cent was generated in private plants. This is a higher percentage of privately generated energy than was reported by any other section of the country. The two other intensely industrial sections, the New England States and the Middle Atlantic States, reported respectively 41.6 per cent and 37.3 per cent of privately generated energy.

There are 669,616 electric motors, with a combined rating of 7,949,849 hp., installed in the industrial plants of the North Central States. Of the total number of motors 60.8 per cent are alternating-current and 39.2 per cent are direct-current machines. This is a higher percentage of direct-current motors than was reported by either the New England or the Middle Atlantic sections. Approximately 51.3 per cent of the total number of motors are under 5 hp.

A study of the industries operating in the North Central States brings out the fact that this is a section of many large industries. There are three industrial groups with an aggregate primary power of more than a million horsepower and eight industries with more than five hundred thousand primary horsepower. There are four industries which consume over a billion kilowatt-hours of electrical energy per annum, these industries being, in the order of importance, the iron and steel, the food, the paper and printing and the transportation equipment industries. In two of these, the iron and steel and the paper industries, the private plant is the predominant factor.

The iron and steel industry has a total installed power of 2,898,036 hp., or approximately 27 per cent of the

Table I—Distribution of the Industrial Power Load in the North Central States

Industry	Total Primary Horsepower	Primary Horsepower Owned by Establishments Reporting				Electric Motors Run by Energy Generated in Private Plants, Hp.	Boilers		Number of Companies Having Private Electric Generating Plants
		Steam Engines (Not Turbines)	Steam Turbines	Internal-Combustion Engines	Water Turbines	Electric Motors Run by Purchased Energy, Hp.	Number	Hp.	
All industries	10,819,210	4,150,814	1,207,217	535,780	312,022	4,613,377	3,336,472	18,755	5,418,796	2,816
Chemicals and allied products	724,930	304,030	133,159	17,149	2,113	268,479	229,181	1,833	621,262	189
Food and kindred products	1,562,360	670,854	70,030	66,662	57,400	697,414	260,758	3,603	936,702	667
Iron and steel and their products, not including machinery	2,898,036	1,334,245	460,198	316,898	2,800	783,895	1,254,257	3,536	1,492,229	252
Leather and its finished products	120,205	52,909	16,203	720	86	50,287	43,695	330	75,946	91
Lumber and allied products	680,123	422,097	24,570	8,022	2,466	221,968	127,330	2,372	509,423	336
Machinery	1,024,273	192,614	59,413	27,193	6,958	738,095	293,546	1,495	311,893	294
Metals and metal products other than iron and steel	237,374	73,387	14,221	2,908	1,973	144,885	52,220	318	89,084	65
Musical instruments and phonographs	32,994	15,224	3,362	353	30	14,025	13,501	299	38,773	24
Paper and printing	850,586	301,239	78,038	3,146	224,294	243,869	245,484	685	243,420	204
Railroad repair shops	303,893	120,966	22,066	11,802	3	149,056	110,645	1,043	237,808	122
Rubber products	289,499	48,963	104,445	68	3,986	132,037	116,870	141	91,935	27
Stone, clay, and glass products	762,081	324,791	70,080	32,717	1,280	333,213	208,422	1,242	287,601	268
Textiles and their products	161,542	64,526	12,272	1,488	5,791	77,465	37,255	392	83,098	123
Tobacco manufacturers	8,705	4,966	526	26	0	3,187	3,262	24	5,088	4
Transportation equipment, air, land and water	968,311	173,376	131,588	42,707	1,443	620,197	323,983	629	299,371	53
Miscellaneous industries	194,298	46,627	7,046	3,921	1,399	135,305	16,063	813	95,163	95

total installed power of the entire section. According to the reports received in this survey and the available government data, these mills are 53.0 per cent electrified. Last year they consumed a total of 2,537,484,000 kw.-hr. of electrical energy, of which 38.4 per cent was purchased from central-station companies and 61.6 per cent was generated in private plants. The rating of the generators in these plants totals 698,267 kva., or more than the combined rating of all the central-station companies operating in Minnesota, North Dakota, South Dakota, Nebraska and Kansas combined. The energy generated per unit of generator installation in the private plants is very much higher than that reported by the iron and steel plants in the Middle Atlantic States, indicating both longer hours of operation and less idle generator equipment. The fact, also, that 25.6 per cent of the steam-power mover equipment in the iron and steel power plants of the North Central States is in steam turbines, while in the Middle Atlantic States steam turbines form only 18.6 per cent of the total steam equipment, would indicate that the private plants in the North Central States embody more recent engineering equipment and are of a higher and more efficient type.

The iron and steel mills of this section have a total of 68,323 electric motors installed, of which more than two-thirds are direct-current motors. Approximately one-third of these motors are under 5 hp. It was hoped that the survey would give a reliable basis for estimating the present status of industrial heating in the iron and steel mills of the country, but the returns on this item were not sufficient to warrant making an estimate. The United States Census Bureau has added questions on industrial electric heating to the survey which it is to make at the opening of next year. It is likely, however, that reliable figures on this subject will not be available until the Census Bureau has tabulated the results of this survey, probably about the first of 1927.

The second industry of importance in the North Central States is the food industry. This industry reports installed power totaling 1,562,360 hp., of which 62 per cent is electrical or is used for the purpose of producing electrical energy. The 667 private generating plants in the food factories and mills generated 534,292,000 kw.-hr. during 1924, or 27 per cent of the total electrical energy consumed by this industry. One-half of the motors installed in the food factories are under 5 hp.

The transportation equipment industry, which includes automobiles, wagons, carriages, shipping, airplanes, etc., is an industry peculiar to the North Central States and especially to the eastern portion of this section. This is an enterprise which has rivaled the central-station industry in the rapidity of its growth. It is essentially a new industry, absorbing in its growth the wagon and buggy manufacturing industry and the shipping industry. Its equipment is largely modern, being reflected in a 43 per cent steam-turbine installation in its power plants and a high degree of electrification—85.9 per cent. A total of 1,311,208,000 kw.-hr. of electrical energy was consumed by this industry during 1924, of which two-thirds was purchased from central-station companies. The ninety-five private electric generating plants have a total generator installation of 195,670 kva., of which 65 per cent is in direct-current machines.

Of the twelve states composing the North Central section, Illinois reported the highest degree of electrification—72.0 per cent. Tabulations of the Southern and Western States are not completed as yet, but the indications are that Illinois leads all the rest of the states in the electrification of her industries. This state has a power installation of 1,980,508 hp., of which 477,860 hp. is in private electric generating stations. The manufacturing plants of the state consumed a total of 2,083,174,000 kw.-hr. of electrical energy during 1924, of which 61.2 per cent was purchased from central-station companies. While the private plants of the state generated 806,786,000 kw.-hr. during 1924, yet one-third of this amount was generated by the plants of one industry—the iron and steel industry. It would appear, therefore, that the central-station industry in Illinois has made large progress toward the elimination of the private generating plants.

Ohio, while reporting by far the largest power installation in manufacturing plants—3,307,726 hp.—is yet only 59.6 per cent electrified. In many ways the power situation in Ohio resembles that in Pennsylvania. The dominating industries are largely the same and the degree of electrification is of the same range, a few per cent higher in Ohio. As in Pennsylvania, the iron and steel industry in Ohio is by far the largest manufacturing industry operating in the state, with a total power installation of 1,559,930 hp., of which 46.8 per cent is electrified. Of the 1,213,500,000 kw.-hr. of electrical energy consumed by these mills in 1924, almost two-thirds was generated in 126 private plants. The private plants have a generator rating of 333,000 kva.

States

...s of January 1, 1924, and Energy Consumed by Industrial Plants During 1924

...timated ...ating of Prime Movers Used in Private ...enerating Plants, Hp.	Number of Companies Having Private Electric Generating Plants	Estimated Electrification of Industry Per Cent	Energy Consumed: Total Energy Consumed, Kw.-Hr.	Energy Consumed: Purchased from Central Stations, Kw.-Hr.	Energy Consumed: Generated in Private Plants, Kw.-Hr.	Generators in Private Plants: Total Rating of Generators, Kva.	Generators in Private Plants: Rating of A. C. Generators, Kva.	Generators in Private Plants: Rating of D. C. Generators, Kw.	A.C. Motors: Number	A.C. Motors: Hp.	D.C. Motors: Number	D.C. Motors: Hp.	Motors Under 5 Hp.: Number	Motors Under 5 Hp.: Hp.
...311,227	2,816	64.0	10,653,041,000	6,151,506,000	4,501,535,000	2,141,601	1,498,988	642,613	407,138	5,134,609	262,478	2,815,240	343,339	796,654
291,980	189	77.6	575,419,000	310,883,000	264,536,000	270,550	139,135	131,415	19,625	293,064	49,778	204,596	45,012	83,724
274,624	667	62.0	1,963,912,000	1,429,620,000	534,292,000	254,429	177,234	77,195	47,914	643,872	29,050	314,300	38,356	102,245
753,738	252	53.0	2,537,484,000	973,976,000	1,563,508,000	698,267	588,199	110,068	22,573	816,507	45,750	1,221,645	21,870	71,440
24,461	91	62.2	96,015,000	51,943,000	44,072,000	22,677	11,786	1,891	9,112	65,664	6,041	28,318	9,574	26,551
39,194	336	38.4	244,669,000	156,132,000	88,537,000	36,296	28,940	7,356	35,587	313,862	5,399	35,436	25,803	68,542
162,488	294	88.5	971,528,000	693,383,000	278,145,000	150,540	88,490	62,050	72,442	607,122	46,428	424,519	76,394	147,551
44,378	65	79.8	218,339,000	161,131,000	57,208,000	41,098	21,805	19,293	6,439	110,917	8,813	86,188	7,342	18,361
7,160	24	64.2	22,348,000	11,386,000	10,962,000	6,640	3,115	3,525	2,920	26,526	408	1,000	938	796
232,425	284	56.0	1,386,467,000	687,235,000	699,232,000	215,425	177,085	38,340	13,225	397,662	9,795	91,691	7,858	21,463
54,905	122	67.1	180,206,000	103,446,000	76,760,000	51,020	32,985	18,035	9,890	148,366	7,417	111,335	6,142	21,968
97,080	27	79.2	500,522,000	265,382,000	235,140,000	90,060	79,705	10,355	54,240	219,803	3,195	29,104	40,907	94,485
60,293	268	51.6	333,500,000	203,642,000	129,858,000	55,843	42,803	13,040	5,558	503,833	3,784	37,802	2,553	7,363
39,581	122	72.6	180,343,000	121,625,000	58,718,000	36,681	29,157	7,524	11,636	88,093	4,950	26,627	12,259	23,490
4,540	8	88.7	10,861,000	5,367,000	5,494,000	4,215	4,215	0	1,463	6,449	0	0	988	1,576
211,200	52	85.9	1,311,208,000	867,635,000	443,573,000	195,670	68,864	126,806	89,531	835,939	10,700	108,241	18,036	53,032
13,180	95	76.4	120,220,000	108,720,000	11,500,000	12,190	5,470	6,720	4,983	56,930	30,970	94,438	29,307	54,067

Central Station and Industrial Practice

Preliminary Tests on New Rechargeable Fuse Switch

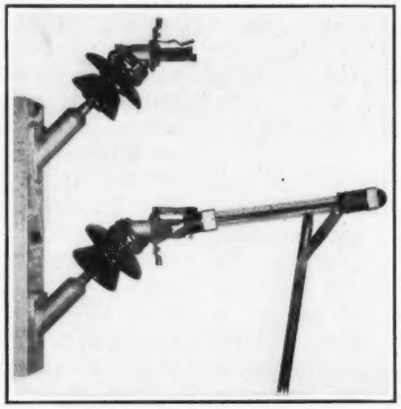
SIXTEEN consecutive short-circuit tests have been conducted by Prof. C. Francis Harding, head of the school of electrical engineering, Purdue University, on a combined rechargeable fuse and disconnecting switch made by the Royal Electric Manufacturing Company. The fuse switch, which was designed for continuous service at 100 amp. and 37 kv., was found to rupture successfully over 8,000 kva. of actually measured power station capacity. According to Professor Harding's report, it is probable from conservative calculations of the short-circuit impedance that the instantaneous short-circuit kilovolt-amperage actually ruptured was in excess of 10,000 kva. at 33,000 volts. The limit to the short circuit ruptured was established by the capacity of the generator and impedance of the circuit. In a subsequent series of tests, in which greater generating capacity and less impedance will be present, the fuse switch will be tested to destruction. Detailed results of the test are presented in the accompanying table.

For making the test, one turbo-generator, with its section of bus and step-up transformers, was set apart at the generating station of a large Illinois company. The 33,000-volt short circuit was closed on the fuse switch by a remote control oil circuit breaker. Facilities were provided so that the fuse switch could be given detailed inspection after each short circuit. The voltages previous to, during and subsequent to the application of the short circuit were read on a voltmeter connected to the secondary of the potential transformer in the short-circuited 33-kv. circuit. An ammeter was connected to a current transformer in the same circuit. The frequency was also determined at the time of the test, although the short circuit was relieved so promptly by the fuse that the frequency was not appreciably effected. Oscillograph records were made of the line voltage, the current and 60-cycle timing voltage.

TABLE I—SHORT-CIRCUIT FUSE-SWITCH TESTS

Test	Rating Fuse Wires, Amp.	Line Voltage, Kv. Initial	Line Voltage, Kv. Short Circuit	Line Voltage, Kv. Recovery	Current on Short Circuit, Amp.	Frequency, Cycles
6	25	33.0	24.6	33.0	92.8	60
7	25	36.0	*	36.0	76.8	61
8	25	35.4	*	35.4	137.0	61
9	25	36.6	*	36.6	41.6	61
10	50	37.2	*	37.2	121.6	61
11	50	36.0	*	36.0	142.4	61
12	50	36.3	*	36.3	134.4	61
13	10	36.6	....	36.6	41.6	61
14	10	36.3	....	36.3	41.6	61
15	25	36.3	....	36.3	73.6	61
16	25	36.3	....	36.3	76.8	61

Tests 1 to 5 were preliminary runs. No readings taken.
* No appreciable drop.



37-KV. FUSE SWITCH IN OPEN POSITION

The switch body is made of annealed boro-silicon glass to withstand the heavy service of outdoor substation replacements and extreme variations of temperature. Heavy cast-copper terminals are rigidly supported on either end of the glass tube holder to assure accurate and positive alignment and adequate contact for the switch blades, which are integral parts of the fuse terminal. The disconnect is opened and closed by means of an insulated pole with especially designed metal forked end. Within the glass outer chamber is mounted rigidly a well-vented Bakelite tube having one-quarter inside diameter, leaving space for circulation of air and gases between its outside surface and the inside of the glass holder. The fuse is refilled by removing the top threaded cap, threading the wire through the barrel of the inner tube, clamping with a wing-nut and replacing in the disconnect clip.

Except in test No. 8, when lead fuse wire was employed, all fuse wires were standard aluminum. The 50-amp. fuse consisted of two parallel lengths of 25-amp. aluminum wire twisted together. In each test, the fuse cleared the circuit automatically except in test No. 4, when the oil circuit breaker was opened by the operator during the short circuit. Upon inspection after this particular test, it was found that the fuse wire was blown and was in small pieces. In all other tests, no traces of fuse wire were found except a small piece under the clamp at each end. Although readily replaceable, the same inside Bakelite tube was used on all tests and was cleaned only after test No. 3. The action of the fuse was particularly clean and very satisfactory, the vaporized fuse wire and gases having been forcibly discharged through the free lower end of the holder.

Conclusions drawn by Professor Harding from a careful study of the construction of this fuse switch and an analysis of the results of the short-circuit tests are as follows:

1. It showed in these tests as a dependable combined fuse and disconnecting switch suitable for circuits up to 37 kv. and 50 amp. (For reasons previously mentioned, the fuse switch could not be tested for greater values.)

2. It is easily and quickly removed and replaced either by means of insulating tongs or by hand.

3. The fuse holder is easily and quickly re-fused on the ground with standard fuse wire and does not require reloading at the factory.

4. This fuse switch may be reloaded by linemen or substation operators not familiar with the details of fuse design and manufacture.

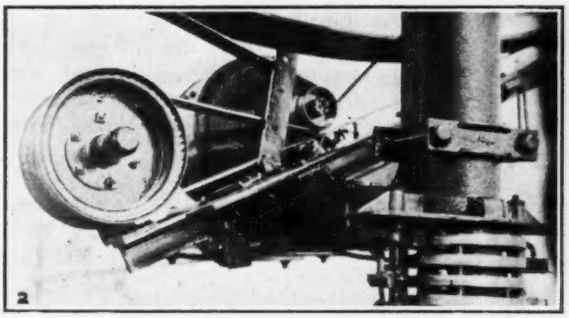
5. The inner tubes or barrels may be readily replaced at relatively small expense if found necessary.

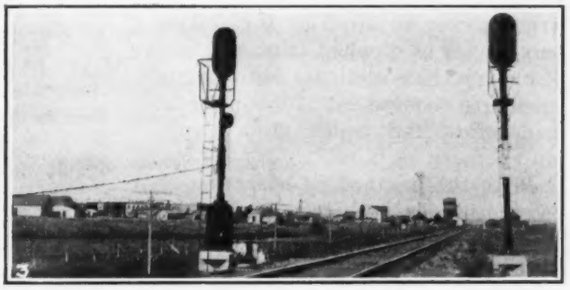
6. This fuse switch not only is sufficiently prompt and self-clearing in its action, even upon short circuit, but its operation is considered such as not to interfere seriously with the service rendered by the other substation and power station equipment operating in parallel with it.

Railway Signals Operated by Windmill

THE Great Northern Railway is now using a specially built wind-operated generator for energizing its block signals. This apparatus is at Culbertson, Mont., and supplies current for the block signals 10 miles in one direction and 16 miles in the other.

In adapting the windmill idea to





WINDMILL OPERATES RAILWAY SIGNAL SYSTEM

No. 1. Sixty-two-foot windmill used for generating electricity.
No. 2. Belt drive for windmill generator.
No. 3. Railway signals that are operated by windmill generator are shown in the background.

the signal system a specially designed 60-cycle alternating-current generator had to be developed with a suitable governor for controlling the amount of windmill blade area exposed to the wind. The latter is accomplished by means of a centrifugal governor located on the wheel. The blades of the wheel are thus automatically controlled according to the velocity of the wind.

The wheel to which the blades are attached is 14½ ft. in diameter, and over the periphery of this is mounted a belt that also runs over the pulley of the generator as shown herewith.

Electric Hot-Plate Used for Tempering Tools

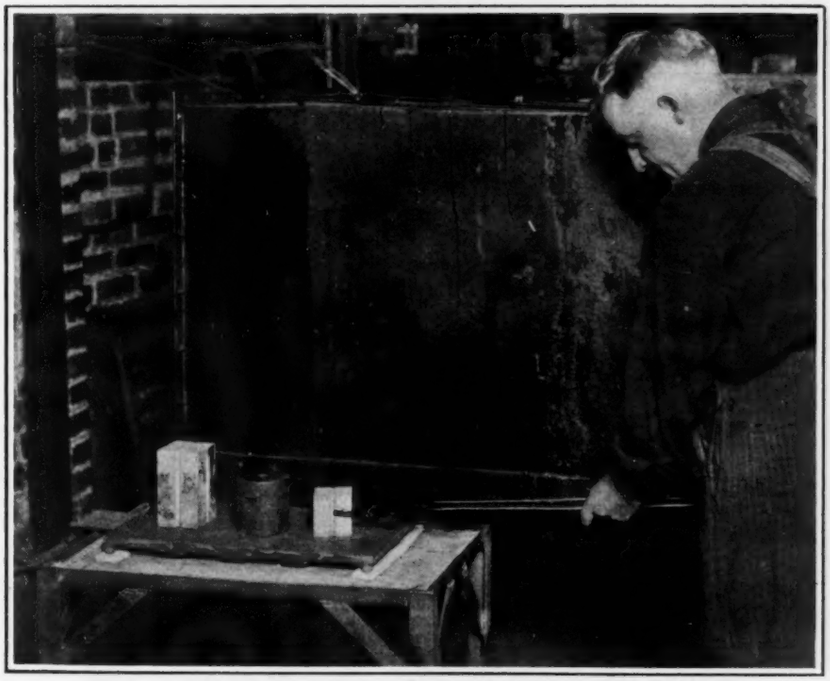
AN ELECTRIC hot-plate is used to lower the temper of the working ends of open header dies and solid cold-forging tools at the plant of the Buffalo Bolt Company, North Tonawanda, N. Y., manufacturer of bolts, nuts, wire and bar material. At this plant, many tools and dies are made which must be specially heat-treated in order to obtain production output on automatic and semi-automatic machines. In the case of header dies and solid cold-forging tools it is essential that the body of the tool be of unusual hardness, it being necessary, at the same time, that the working ends themselves have less of the characteristic of hardness and more that of toughness.

The dies and tools are first heated to a temperature of 1,450 to 1,500 deg. F. in an electric furnace and then quenched in a saline solution. After cooling they are again heated, this time in an electrically heated oil tempering bath to a temperature of approximately 450 deg. F. They are then allowed to cool to normal air temperature. Ordinarily this cycle would constitute the complete heat-treating process.

The tools and dies in question, however, are subject to great strains and shocks. In the case of carriage bolt open header dies particularly the square neck opening with its sharp corners constitutes a weak working part, and unless sufficient toughness is imparted to the metal at this point the life of the die will be short.

Accordingly, in order to provide the proper element of toughness at the point where it is needed, without destroying the great hardness in the body of the dies and tools themselves, the bolt company installed an electric hot-plate, manufactured by the General Electric Company, for tempering the ends. The dimensions of the plate are approximately 9x18 in. and the electric heating element, suitably insulated, is cast in the plate itself, providing a strong construction for withstanding the severe service imposed. The plate rests on a small, electrically welded frame about 2 ft. in height.

After cooling from the oil-tempering treatment, the working ends of the dies and tools are polished with emery cloth. They are then placed on the heated plate and left there until the ends assume a bluish color, indicating that the drawback operation has been completed. They are then removed and allowed to cool in the open air. The hardness of the working ends is thus reduced



TEMPERING DIES ON AN ELECTRIC HOT-PLATE

to give greater toughness and less brittleness, the original hardness of the tool and die body remaining. The operation is quickly performed and has been found to increase materially the life of the dies and tools.

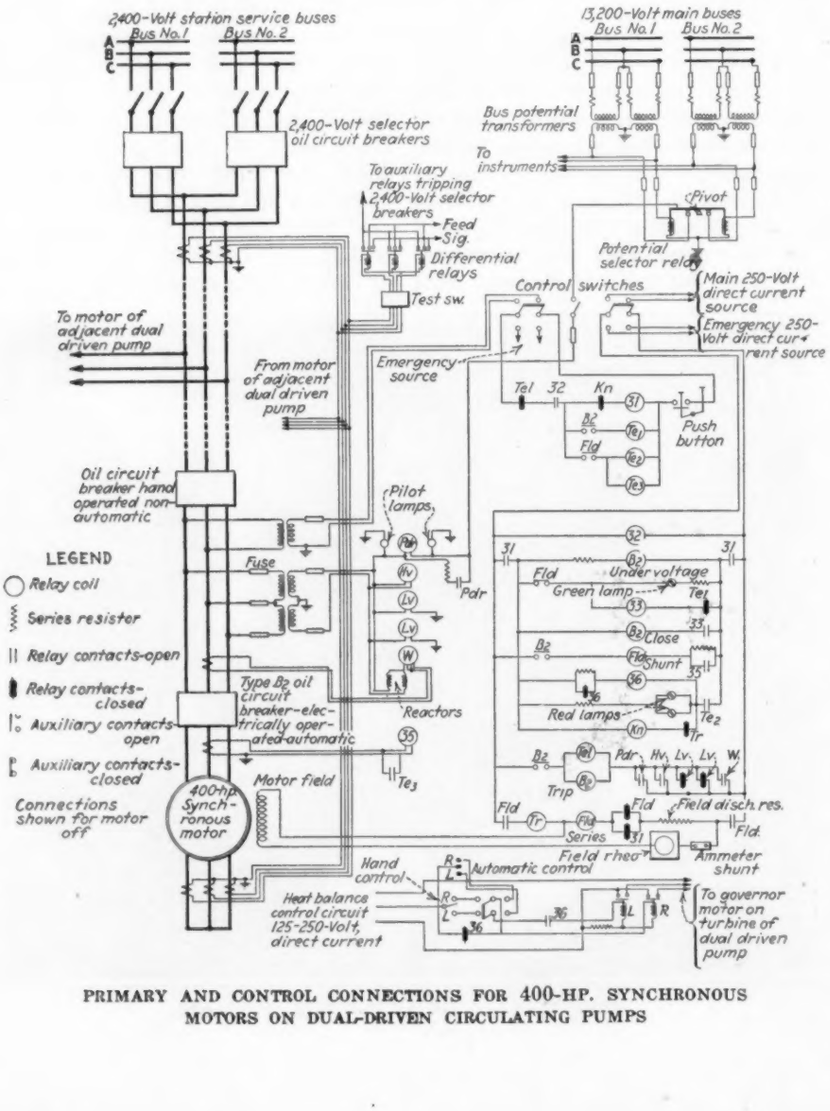
Control for Dual-Driven Circulating Pumps

The Philadelphia Electric Company Uses Synchronous Motors in Its Delaware Station for Circulating Pumps—Detailed Control System Described

BY JOHN W. ANDERSON
Station Engineering Department, Philadelphia Electric Company

SOME of the advantages of using synchronous motors for circulating pumps were described in a previous article (see ELECTRICAL WORLD for Nov. 7, 1925, page 954). The primary and control circuits for these motors are described in the following article. The 2,400-volt bus sections shown in the accompanying drawing are part of duplicate buses, each sectionalized by a normally open oil circuit breaker. The four sections thus formed are each supplied through a transformer bank from whichever main station 13,200-volt bus is in service. All the electrical power required by the station auxiliaries is supplied from the four 2,400-volt bus sections, with corresponding equipment for different generators and boiler groups split up on these sections.

With this method of operation, it is exceedingly unlikely that any kind of electrical failure will affect more than a small portion of the station auxiliaries. Three feeders, each supplying two motors and connected to different bus sections, are provided for the six dual-driven sets. These connections, as well as the normal method of operating the entire station, were shown in the ELECTRICAL WORLD for May 10, 1924, page 935.



PRIMARY AND CONTROL CONNECTIONS FOR 400-HP. SYNCHRONOUS MOTORS ON DUAL-DRIVEN CIRCULATING PUMPS

The normal method of starting these sets is to bring them up to speed with the turbine, the pump valves being closed, and then to put the motor on the line with its push button controlled starting equipment. The motor, however, is capable of starting the entire set from standstill, but this is not done because of the strain on the reduction gears between the pump and turbine shafts, and also because of the necessity of having steam in the turbine to keep its blades cool.

Before putting a motor on the line, it is necessary, of course, to see that one of the 2,400-volt selector oil circuit breakers and the hand-operated breaker in the motor feeder are closed. The hand-operated breaker serves merely to disconnect the motor and its control breaker from the line and has no direct part in controlling the motor, the *B2* breaker taking care of starting and stopping operations under all conditions. It is also necessary to see that the three control switches are closed. One of the D.P.D.T. switches controls the supply to alternating current relays, and the other to direct current relays and the motor field, duplicate sources being provided in each case. Closing the direct current switch picks up direct current voltage relay No. 32. The S.P.S.T. control switch puts a feed from the 13,200-volt bus potential transformers on phase displacement relay *PDR*, the purpose of which is discussed later. The only manual operation in starting the motor is to push the starting button; the sequence of relay operation is then as follows:

Master relay No. 31, the function of which is to connect the direct-current control feed to the automatic relay equipment, is energized upon the operation of the start button and immediately closes its main contacts. This operation lights the green starting lamp, picks up the under-voltage coil on the *B2* breaker, and energizes *B2* breaker control relay No. 33 through the contacts of time delay relay *TE1*. Relay No. 33 energizes *B2* breaker closing coil, closing the breaker and starting the motor.

The closing of the breaker energizes the operating coil of time delay relay *TE1*, which, after giving the breaker time to seal in, opens its contacts, thereby de-energizing breaker control relay No. 33, which in turn removes potential from the breaker closing coil.

The closing of the breaker also completes the circuit to the shunt coil of field contactor *FLD*. Alternating-cur-

rent relay No. 35, operated by the motor current, shunts out the resistor in series with this coil, thereby energizing it with full control voltage. However, the series coil of the field contactor, which carries the heavy alternating current induced in the motor field during starting, opposes the shunt coil until the induced current drops to practically zero—that is, until the motor is practically at synchronous speed. The field contactor then operates, cutting the field discharge resistor out of the circuit, applying voltage to the motor field, and removing potential from the green starting lamp.

The operation of the field contactor completes the circuit to two other time delay relays *TE2* and *TE3*, which operate after giving the motor time to settle down after the application of the field. *TE2* lights the red running lamps, one of which is on the relay panel and the other on the gage board of the main turbine, energizes heat balance control relay No. 36, which places the automatic heat balance control feature in operation and also puts a feed on the contacts of field current relay *TR*. *TE3* short circuits the coil of alternating-current relay No. 35, thereby removing the shunt from the series resistor used with the field contactor shunt coil. This completes the starting operation.

In order to stop the motor, the stop button is pushed, removing potential from the master relay and the three time delay relays. The tripping of the master relay de-energizes all direct-current relays except direct-current voltage relay No. 32 (controlled by the D.P.D.T. switch. The *B2* breaker is tripped by its low-voltage coil, and the field discharge resistor has in the meantime been paralleled with the motor field. The operation of the heat balance control relay causes the turbine to pick up the motor load.

Various abnormal conditions are taken care of by protective relays as follows:

In case of total loss of supply voltage, such as would be caused by the opening of an oil circuit breaker in the supply circuit, the motor breaker is opened by one or more protective relays. Whenever the motor is cut apart from the system and the motor voltage becomes out of phase with the system voltage by a predetermined amount, phase displacement relay *PDR* operates to trip the *B2* breaker and also energizes relay *TEL*. Relay *TEL*, known as the temporary lockout relay, immediately opens the circuit of master relay No. 31, thereby causing all relays to assume their "off" position. This, of course, includes disconnecting the motor field supply, so that there is no danger of reconnecting the motor while it is out of phase with the system. The contacts of the temporary lockout relay automatically close again in about ten seconds; and if the supply voltage is then above 80 per cent of normal, the motor will automatically restart.

As will be seen from the illustration, the operating coil of the phase displacement relay *PDR* is connected both to the motor feeder and to the main 13,200-volt buses through suitable potential transformers. As only one of the 13,200-volt buses is used at a time, it was necessary to provide a relay to connect automatically the phase displacement relay to the live potential transformers. The potential selector relay fulfills this purpose. It is so arranged that when operating, as is normally the case, with only one coil energized, energizing the other coil will not change the contact positions until the first coil is de-energized. This feature permits the bus which is not carrying the station load to be used for "slow engine" or other tests which it may be necessary to make on apparatus throughout the system without affecting the protection afforded these motors.

High-voltage relay *HV* and watt relay *W*, which is connected as a reverse power relay, act as a second line of defense under the condition of total loss of supply voltage. Since the motor is overexcited, its voltage will rise considerably above normal when the supply is cut off unless it is required to carry a fair amount of load as a synchronous generator. Should loss of supply voltage occur because of the opening of a main transformer switch, such as would be the case if the transformer failed, it is evident that the motor would try to carry whatever load was connected to the 2,400-volt bus. Under a condition of this kind, the high-voltage relay will operate if the load which the motor picks up does not exceed 90 kw. at lower than 70 per cent power factor, and the watt relay will operate if the load is greater than 90 kw. The operation of either of these relays energizes the *B2* breaker tripping coil and the temporary lockout relay, thus immediately opening the *B2* breaker and automatically restarting the motor in about ten seconds if conditions are approximately normal. The watt relay, of course, operates in this manner whenever the motor reverses and attempts to supply more than 90 kw. to the system. However, the turbine valves are so adjusted that the turbine cannot get sufficient steam to supply this amount of power to the system while it is also carrying the pump load.

In case of partial loss of voltage, the motor remains on the line until the voltage drops below the minimum value which will permit it to carry the full pump load; at that value the low-voltage relays *LV* operate to trip the *B2* breaker and energize the temporary lockout relay.

Should the excitation and control voltage fail, all direct-current relays are de-energized, including direct-current voltage relay No. 32, which opens the master relay circuit. The motor breaker is tripped by its under-voltage coil. When direct-current voltage is restored, relay No. 32 picks up, closing the master relay circuit, and thus restarting the motor.

If the field becomes open circuited, field current relay *TR*, in series with the field, is de-energized, thereby operating permanent lockout relay *KN*, which opens the master relay circuit and shuts the motor down. Relay *KN*, being hand reset, locks the motor out permanently.

Failure of the motor armature is of course taken care of by the differential relays.

The first two of these motors have been in operation a year and a half and the third a little more than a year. Thorough tests on the first two indicated that the installation would be entirely satisfactory, a conclusion that has been borne out by the actual operating experience thus far obtained. During 1924 two similar dual-driven pumps were installed for the two new 30,000-kw. generators placed in service at Chester station, and two are being installed for the two older 30,000-kw. units at Chester.

The complete dual-driven pump sets were furnished by the Westinghouse Electric & Manufacturing Company, the details of the motor control being worked up by the close co-operation of that company's engineers with those of the Philadelphia Electric Company.

Montana 66-Kv. Line Uses Original Insulators

ONE OF the first high-voltage transmission lines to be built in Montana extends from Canyon Ferry to Butte, a distance of 65 miles. With the exception of a few insulators that have been broken by rocks or shooting and some poles that have been stubbed or reset, the line remains in service today with the original 9-in. Hemingray glass insulators, paraffine-impregnated oak pins, wooden cross-arm braces and untreated cedar poles that were installed in 1901. The line has been in operation at 66 kv. since first installed and is still giving satisfactory service after 24 years.

MONTANA TRANSMISSION LINE BUILT IN 1901 STILL IN OPERATION WITH ORIGINAL PINS, INSULATORS, POLES AND CROSS-ARMS

Commercial Activities and Public Relations

A Uniform Structure for Electric Rates

Method of Applying Capacity, Energy and Customer Charges to All Classes of Service—Increased Use of Energy by Domestic Customers an Important Feature

BY PHILIP CHAPIN JONES
Akron, Ohio

WITH the rapid growth of electric public utilities the question of equitable rates and charges became of increasing importance. It was early recognized that the electrical-generating companies were natural monopolies and thus that their profits were not subject to the control of competition. The only other evident curb was government control, and the various states rapidly arose to the occasion and created state public utility commissions, delegating to them rate-adjusting powers in various degrees.

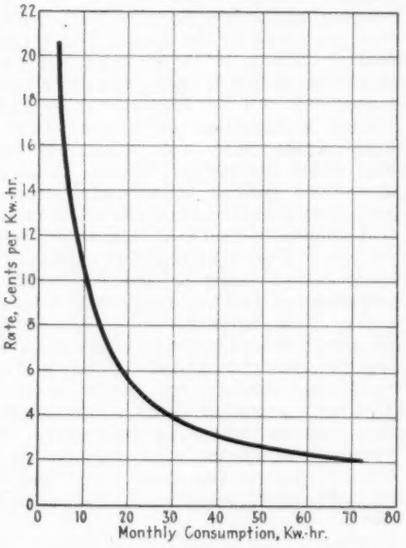
Inequalities in existing rates were apparent. The situation was aggravated by lack of standards of comparison. Conditions and costs were different, of course, in different localities and these natural inequalities when presented in the frames of heterogeneous accounting systems presented appearances in no way alike.

The first step in the amelioration of this unfortunate situation has already been taken. The state utility commissions, banding themselves into a national association, have formulated a standard classification of accounts with instructions as to its use. Most of the states have adopted or are about to adopt a standard classification either identical or very similar to this one.

Thus the time is in sight when the public utilities will speak a common financial language. One big step yet remains—to formulate a standard rate structure whereby these costs now arranged and classified in a uniform manner may be charged out to the consumer in an equitable and uniform way. It is as a suggestive guide in this direction that the present article is written.

All expenses of an electrical utility may be divided into three groups, each group being, in general, proportional to one of the three main elements in the business: the first to the size of the plant, the second to the number of production units generated, and the third to the number of customers. Viewed in this manner the three groups of expenses will be as given below:

Group I—Capacity Charges. Interest on indebtedness, taxes, insurance, depreciation, general office expense, power plant labor and allowable profits. This includes accounts numbered 701, 706, 709, 721.1, 721.2, 731.1, 731.21, 731.31, 781 to 790 inclusive, 403, 404 and 431 to 443 inclusive as given in the Uniform Classification of Accounts for Electric Utilities published by the National Association of Railway and Utility Commissioners.



APPLICATION OF THREE-PART RATE TO RESIDENTIAL CUSTOMER

Group II—Energy Charges. Costs of fuel, supplies, maintenance, transmission and distribution losses. This includes all accounts numbered 702 to 705 inclusive, 707, 708, 710, 711, 712, 721.3, 721.4 to 721.9 inclusive, 731.22, 731.32, and 731.4 to 732.71 inclusive in the same classification.

Group III—Customer Charges. All charges proportional to the number of customers such as meter and billing costs. This includes accounts numbered 731.51 to 731.54 inclusive, 732.72, and 760 to 771 inclusive, also in the same classification.

To charge out these costs fairly a threefold rate must be used. In the early days of the industry the attempt was made to keep the rates as simple as possible. It was thought advisable to have a flat rate per kilowatt-hour or per horsepower-year. The feeling was that a more complex rate, though it might better represent the actual cost of service, would be for the most part unintelligible to the customer and therefore distasteful to him. We have fairly well outgrown this situation now, however, and very few of the simple one-part rates still exist. In the whole business world the tendency is more and more to make selling price correctly proportional to costs and in the future it will undoubtedly be easier to defend a just rate, no matter how complicated, than an unjust one, no matter how simple.

As the total expense of a utility is proportional to three different factors—installed capacity, generated kilowatt-hours and number of customers—it is evident that in an equitable rate these three portions of expense should be charged out in proportion to the demand the user makes on them. Thus if any customer has a demand of X kw. and uses Y kw.-hr. per month, his monthly bill Z should be:

$$Z = AX + BY + C \qquad (1)$$

where

A = Group I expenses $\div$ total of customers' demands $= S_1 \div \delta P$ (2)

P = Plant capacity in kilowatts.

δ = Total of customers' demands $\div P$.

S_1 = Group I expenses

and B = Group II expenses $\div$ total kilowatt-hours generated $= S_2 \div G$ (3)

G = kilowatt-hours generated by utility.

S_2 = Group II expenses

and C = Group III expenses $\div$ number of customers $= S_3 \div U$. (4)

U = number of customers.

The general bill structure represented by equation (1) is a plane surface inclined to the X, Y and Z axes by angles depending on the relative values of S_1, S_2, and S_3. A, B and C are the rate elements and will vary with the different companies and for different classes of service with the same company.

Inasmuch as different classes of services take energy at different voltages and thus demand more or less equipment in the way of distribution systems and transformers, the costs in Groups I and II will be divided in general into several subgroups forming the elements of several rates. Thus to form a rate for large consumers taking power at primary voltage S_1 and S_2 would include no distribution costs. Customers taking energy at distribution voltage would have a rate in which elements A and B were computed from costs including the distribution system but not including the distributing transformers or low-voltage lines, whereas secondary voltage customers would have rates made up of factors A and B which included all expenses and fixed charges of the utility. The rate for each customer would be of the form given in equation (1), but the constants A and B would be different for each different class of service.

In this manner the actual rates would be easy of determination and just for all. Estimated figures of δ, G and U would be used based on previous years' experience. Not only would such a uniform rate structure simplify litigation and commission procedure but it would increase the use of electricity for domestic purposes and thus lower costs by improving load factor.

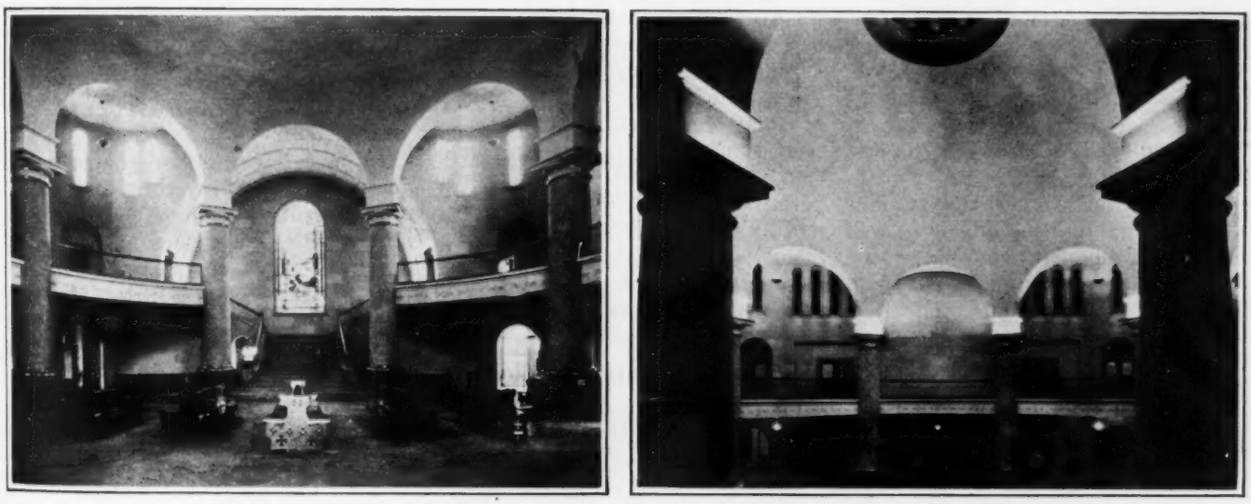
A typical residential rate built up on such a scheme might have constants as follows: $A = 1.00$, $B = 0.006$, $C = 0.50$. As applied to a customer with a 500-watt demand, the minimum bill would be $1 a month and the rate would be as shown in the accompanying illustration. With a monthly consumption of 11 kw.-hr. the rate would be about 10 cents per kilowatt-hour. If the consumption were raised to 36 kw.-hr. a month, the rate would drop to 3½ cents.

Several advantages of such a system have been mentioned and others will become obvious on a more detailed examination. The big underlying value of this scheme is that each class of service is profitable in itself and one group is not made to pay the cost of carrying another.

Modern Illumination of Railroad Station

BY B. C. REBER
San Antonio, Tex.

THE rejuvenated railroad station of the International & Great Northern Railroad in San Antonio, Tex., has a combined beauty and convenience in lighting effects probably not surpassed by any other similar building in the country. To bring out the decorations, it was necessary to give careful consideration to the lighting effects; for, without properly placed lights, the effort of the painters and decorators would have been wasted.



TWO VIEWS OF SAN ANTONIO RAILROAD STATION HAVING MODERN LIGHTING EQUIPMENT

In the main rotunda, the tops of each of the 59-ft. columns are utilized to conceal the nine 150-watt, E. C. No. 68 X-ray reflectors. Distribution is attained by placing two lights on each side of the columns, the remaining five being located on the front, or inside, of the columns, facing the lobby. These lights are so located on a separate circuit that it is possible to switch off all of the lights except the center light on the inside of the column. This light is controlled by a remote switch operated from the ticket office and gives sufficient illumination during the early morning hours.

The center of the dome, which is 77 ft. high, has a smaller, auxiliary dome, which is illuminated by means of thirty-four 50-watt lamps bearing X-ray hood Junior No. 11 reflectors. These lights serve to bring out the sky effect painted in the dome and are controlled by three separate switches.

Underneath the mezzanine floor, which surrounds the lobby, four indirect, decorative lighting units have been used to furnish the proper illumination. These are of 300 watts each and are finished in old gold. Suspension is from the ceiling by means of 30-in. chains, finished in the same tones as the lights. A like arrangement, only in larger proportions to allow for the difference in height, has been used above the mezzanine, where 500-watt lamps are suspended by means of 6-ft. chains.

The stairways and arches are lighted by four 12-in. decorative metal urns, finished in green gold and being of an indirect lighting type. They are known as type 345 X-ray reflectors.

In the main entrance two 200-watt ornamental, pendant-type lanterns with an old gold finish are used. The southwest and northwest entrances are also lighted by two 200-watt indirect-lighting units,

known as No. 2541-M, X-ray equipment.

The waiting rooms are equipped with indirect-lighting fixtures of 300-watt capacity, No. 551 duplex lights, having chain suspension and being finished in old gold. A semi-direct lighting effect is obtained.

In the ticket office, the illumination is obtained by means of indirect-lighting units of 500-watt Duplexalite D-551. Further illumination is furnished directly over the ticket windows by trough-section lighting, a 5-ft. section carrying 25-watt lights in twin receptacles being used.

The train sheds are equipped with 12-in. shallow reflectors using 75-watt bowl-enameled lamps, and the runway is lighted by three 200-watt No. 575 X-ray reflectors on 18-ft. centers.

All lighting is controlled from one main panel board. Remote control panels are also located in the ticket office for governing the single lights at the top of each column as well as the small lights in the auxiliary dome.

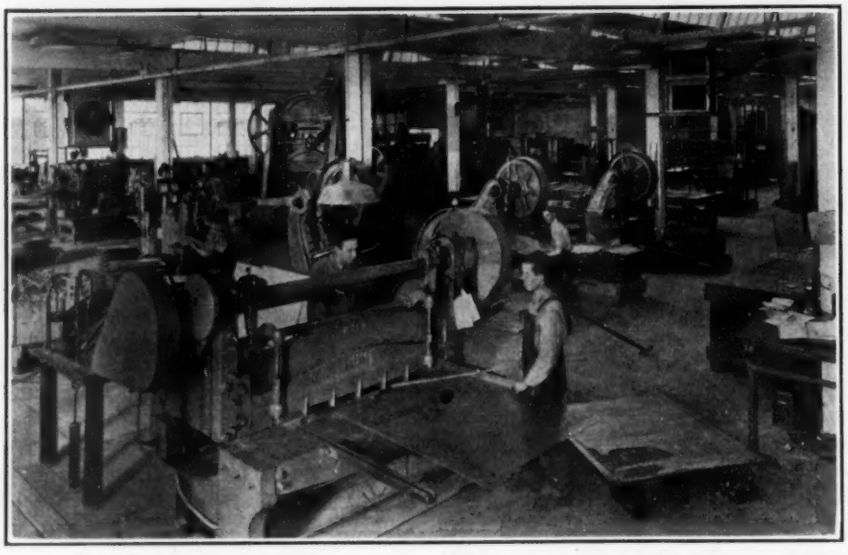
The finished station, in its rejuvenated form, has gained considerable favorable comment on account of its unusual lighting effects as well as the convenient manner in which they have been arranged to give immediate control and economical operation. The electrical work was by Wright Brothers of San Antonio, and the lighting plans were laid out by C. J. Blum, illumination engineer of the San Antonio Public Service Company.

Quick Service at Cambridge

EXCEPTIONALLY rapid service in connecting new customers is given by the Cambridge (Mass.) Electric Light Company. In the majority of cases where a pole line passes the premises service is made available before nightfall on the day the city permit is received if this is filed before 11 a.m.

This expedition is attained, first, by having a groundman on the company service truck who is capable of setting meters and cutting in the service, and second, by anticipating meter installations by running meter loops and service drops ahead of the formal permit in territory requiring new facilities. The meter is set with dummy fuse plugs and sealed until the permit is obtained. A maximum of forty-eight hours is seldom exceeded unless delays arise in connection with pole location or excavation permits. About 3,700 new customers will be added this year and a single truck with two men handles the work, installing from eight to ten services and meters a day.

Individual Drive in Electrical Manufacturing Plant



IN KEEPING with modern industrial drive practice, the A. G. Manufacturing Company of Seattle, Wash., used individual motor drive on all machines in its new plant shown in the accompanying illustration. In a plant of this type, where switches and switchboxes are made, the shears, punches and drill presses used lend themselves ideally to individual drive, which makes for a neat and orderly plant free from a maze of overhead shafting and belting. A further factor contributing to the efficiency of the individual operator is the foot controls used for starting and stopping the various machines. The lighting system installed provides adequate illumination for night work.

Aggressive Merchandising in Nashville

AT THE meeting of the Southeastern Division of the N. E. L. A., H. W. Cameron of the Nashville Railway & Light Company outlined to the commercial section some important facts about merchandising. He pointed out that with about 27,000 residential customers in Nashville a total appliance business of $266,000 had been done in the first nine months of the year by the central-station merchandising department, or a sale of about ten dollars per customer under conditions where dealers and other outlets were numerous.

This business was divided as follows: $9,000 for house-to-house sales of lamps, $59,000 for irons, toasters, percolators and cleaners, $46,000 for ranges, $33,000 for washing machines and $81,000 for refrigerators. As compared with business of the previous year, the percentage increases were as follows: 22 on irons, 50 on vacuum cleaners, 114 on washing machines, 15.7 on ranges and 453 on refrigerators. The large increase on refrigerators and washing machines came about because these articles had been actively merchandised only during this year. At the present time this company sells thirty washers, forty vacuum cleaners and thirty-five ranges per month, and has placed 155 refrigerators on its lines this year.

In commenting on merchandising principles and items Mr. Cameron stated that the washing machine was a good article for the central station to merchandise, but that it must be sold properly. The electric refrigerator had developed more rapidly for the effort expended than any other article of merchandise and offered fine opportunities for development. The cardinal principle in merchandising is educational, in the opinion of Mr. Cameron. People must be brought to think about appliances before they will buy and, further, any utility can afford to maintain a service staff to see that appliances sold are kept in use and are added to. He said his company spent about 4½ per cent of gross sales on general advertising. He added that he was a firm believer in cooking schools, demonstration house-to-house servicing and sales and that the buying public must be reached directly and frequently with ideas that interest if merchandising is to be done successfully.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Mechanical Features Affecting Reliable and Economical Operation of Hydro-Electric Plants.—E. A. DOW.—This paper deals with the subjects of flashboards, trash racks, rack rakes, sluicegates, headgates and discharge-measuring devices from the standpoint of economy and reliability of operation, based almost entirely on the New England Power Company's practice. It stresses the importance of reducing head losses and leakage and adhering to strength and simplicity in the design of hydraulic equipment. It is illustrated with numerous drawings of typical elements in hydraulic plants.—*Mechanical Engineering*, October, 1925.

Steam Ejectors in Condensers for High Vacua.—N. A. LAMB.—The development of the steam-jet air pump is the inevitable outcome of the rapid increase in size of turbines during the last ten years. The advantages consist in the absence of all moving parts; hence negligible wear, modest dimensions, suitableness for high vacua and adaptability for supplying air-free feed to the boilers. Further, it is found advantageous to operate in two stages —with a 28-in. vacuum, for example, compressing first from 2-in. to 8-in. pressure, then in another stage from 8 in. to 30 in. or atmosphere. All steam-jet condensers consist of a steam jet, in which the steam is expanded down to condenser pressure, in the case of the first-stage jet; a space in which the air and vapor come into contact with and are entrained by the rapidly moving steam, and the diffuser, in which the speed of the total mixture of air and vapor is gradually reduced and the pressure increased. The considerations which govern the design of such an ejector, based partly on experience and partly on thermodynamic laws, are discussed by the author.—*World Power*, October, 1925.

Generation, Control, Switching and Protection

Overload Capacity of Trip Coils.—R. EDLER.—The overload tripping mechanisms on certain oil switches are actuated by magnet coils, placed directly in the high-voltage circuit and in series with the breaker. During overloads and short circuits the windings of such magnet coils have to withstand many times their rated current for a duration depending upon the time setting of the breaker. Inadequately dimensioned windings have been frequently the cause of burn-outs and serious damage. Starting from the general heating formula, the author calculates the maximum time setting for various currents, allowing a certain permissible heating of the magnet coils. The results of the theoretical conclusions are given in several heating and time curves, from which all desired data can be readily obtained. A number of practical examples illustrate the proper use of the formulas and curves.—*Bulletin de l'Association Suisse des Electriciens*, No. 9, 1925.

Differential Protection.—P. BARY.—Differential relay protection on power lines and large transformers is widely used today, and it is customary, particularly for very high voltages, to employ for this purpose current transformers which are built into switches or transformers and are arranged around the high-voltage leads. These so-called bushing transformers are simple and inexpensive, but they require certain design and connection precautions which are essential for their proper functioning as sources for differential protection. The influences of relative size, magnetic reluctance and capacitance must be carefully considered and adjusted to prevent untimely response of the relays. In this paper the author shows mathematically the basic requirements of these bushing transformers and describes a specially suited type. A number of connection diagrams indicate the various methods of using these transformers properly for differential relay protection.—*Revue Générale de l'Electricité*, Oct. 3, 1925.

Transmission, Substations and Distribution

Faults in Cable Splice Boxes.—F. FLÜCKIGER.—In low-voltage underground lead-sheathed cables faults are frequently experienced at the splice boxes. Particularly on single-conductor cables, heating and even firing will occur between the neck of the splice box and the lead sheath when a double-pole ground occurs. Such faults may not be noticeable until weeks or months after they occur, by which time the humidity of the soil will have had occasion to complete the corrosion. A public service company of a large Swiss city has laid out two cable trunks for the express purpose of testing various methods of safeguarding against such faults. After experiences covering a period of several years it has been found that best results can be obtained when the lead sheath is reliably insulated from the metallic junction boxes. Gutta percha, from which a collar around the sheath was shaped at a temperature of 60 deg. C., gave best results. Tarred tape is not recommended for this purpose. Its hygroscopic character soon attracts sufficient humidity to cause failure.—*Bulletin de l'Association Suisse des Electriciens*, No. 9, 1925.

Distribution to Supply Increasing Load Densities in Residential Areas.—M. T. CRAWFORD.—An outline is given of the plans and construction of the Puget Sound Power & Light Company designed to meet the new conditions along residential distribution lines in and around Seattle. The diversified feeder demand has been estimated to average 500 watts per residence having only lighting and small appliances, 1,250 watts per residence having a range also, and 1,600 watts when the residence has in addition a large water heater. An average city block has been taken to include 0.004 square mile and to contain from sixteen to twenty fair-sized lots and the necessary street area. For the near future an average maximum load density of 25 kw. per block, or 6,250 kw. per square mile, has been assumed, based on seventeen houses per block, five with range and water heater, eight with range alone and four with only lighting and small appliances, plus a thirty-range apartment house every six blocks.—*Journal of A. I. E. E.*, October, 1925.

Units, Measurements and Instruments

Air-Gap Magnetic Field in Non-Salient Pole Machinery.—Part I.—B. HAGUE.—This part lays the theoretical foundation for those to follow. After demonstrating that the usual method of treating the mmf. of an armature winding can give little or no information about the distribution of the field and is therefore of limited value in the theory of electromagnetic machines, the author shows that it is necessary to develop a method based upon the fundamental principles of electromagnetism, even at the expense of greater mathematical complexity. Following a discussion of the similarities and differences between a "potential" and a "curl" field, he shows how the principle of duality may be applied in the solution of magnetic field distribution due to currents by making use of known solutions of electrostatic problems. In the analogy thus used the magnetic lines of force become equivalent to electrostatic equipotentials, and vice versa, the potential function of one being equal to the flux function of the other. This principle enables him then to apply the method of images to the electromagnetic problem.—*World Power*, October, 1925.

Scientific Exhibits at the British Empire Exhibition.—The description is continued from an earlier issue of new apparatus for measurement and demonstration. Included are devices for showing penetration of the very short γ-rays through various metals, change of discharge of an X-ray tube with reduction of vacuum, a high-vacuum double rotary pump weighing 16½ lb., driven by a 1/12-hp. motor and capable of discharging 415 cu.in. of free air per minute, and a mercury-vapor pump that produces a vacuum of 0.00001 mm. against a back pressure of 1 mm.—*Engineering* (*England*), Oct. 2, 1925.

Illumination

Luminous Fountains.—A. CURCHOD.—During a recent exposition in Paris some spectacular performances on the River Seine were carried on by means of a specially built and installed array of luminous fountains. Along each side of the Alexander Bridge a steel pipe 1 ft. in diameter with 9,000 small holes was suspended, and a 200-hp. motor pump delivered water under pressure to these two pipes. The closely spaced water jets formed a parabolic curtain on each side of the bridge. A large number of 2,000-cp. floodlights,

arranged under the bridge and out of sight, illuminated these two curtains brilliantly. As it was necessary to point all of these flood lights downward, their reflectors had to be water-cooled to prevent overheating. Near the bridge several floating luminous fountains were installed. These were specially designed for the purpose and entirely self-maintained. They consisted of round steel caissons of 23-ft. diameter, containing two motor pumps for the high-pressure water and three rings of floodlamps, throwing beams of light through water-tight glass panels upward upon the rising jets of water. There was room within the caisson for an attendant who changed color filters on the floodlamps. The two pumps were of 60 hp. and 200 hp. respectively, and there were eighty-four reflectors of 3,000 cp. each in the three concentric rings. The power supply to these fountains was insured by flexible cables from the shore. Harmonious color effects were assured by means of telephone interconnections between the fountains and to the shore.—*Revue Générale de l'Electricité*, Oct. 3, 1925.

Motors and Control

Electric Drive of Ring-Spin Machines.—W. KERB.—The drive of a spinning machine should be rhythmically adjustable in speed during the completion of a bobbin on account of the limited strength of woolen and cotton threads. The author describes various electrical and mechanical ways to accomplish automatically such a subtle speed regulation. On an average a 12 per cent variation of speed is required. Alternating-current commutator motors give the best performance, since with brush shifting a stepless change of speed may readily be obtained at a uniform electrical efficiency. The high price of such motors and the general weaknesses of a commutator make it, however, less desirable. Straight induction motors with four-to-six pole change are cheaper and more reliable, but give only two speeds. Another method is to supply alternating current of two frequencies, with ordinary induction motors switched to one or the other supply.—*Elektrotechnische Zeitschrift*, Oct. 1, 1925.

Agricultural Induction Motors.—L. RIEFSTAHL.—A three-phase induction motor driving a machine with a power demand far below the motor's capacity will operate at a very low power factor. This condition will be met frequently on farms where one motor is installed with sufficient capacity to operate a threshing machine, the same motor being used to run grinders, cutters, pumps, etc., all of which require much less power. A motor is described for this purpose which has in its rotor an auxiliary excitation winding to supply the stator winding over a commutator and three brushes. A rheostat can adjust the excitation so as to make the motor carry up to 35 per cent overload at unity power factor or to supply rated load and 10 per cent leading current to the supply. A sparkless commutation is assured under all conditions.—*A. E. G. "Progress,"* September, 1925.

Heat Applications and Material Handling

Novel Motor Drive in Brass Mill.—GILBERT L. LACHER.—The power units of a brass mill are described, the plant being electrically operated not only as to mechanical handling but also as to melting, for which purpose four induction furnaces are used taking 60 kw. per furnace when in active operation. The special feature is the use of synchronous motors to drive the rolls, there being three rated at 250 hp., with a 90 per cent leading power factor, running at 50 deg. C. rise on a three-phase, 60-cycle, 440-volt supply, at 514 r.p.m. —*Iron Age*, Sept. 17, 1925.

Heating by Electricity in the Chemical Industries.—ROBERT M. KEENEY.—The paper first briefly reviews the history of the application of electrically generated heat both by the arc and by means of resistance. The latter method, using metallic resistors, is limited by the life of nickel-chromium alloys to the production of temperatures up to 1,850 deg. F. The physical properties of such alloys are therefore of interest. These are tabulated in the paper, as are the chemical compositions of a larger group of resistance alloys containing nickel, chromium, iron, manganese and silicon. Finally the economics of the heating problem are discussed and applications in various industries are described. Attention is called to the fact that the actual cost of the heat produced is only one of the factors to be considered. In this item alone the cost per thermal unit is likely to be considerably higher with electricity than with coal or oil fuel and roughly equal to that with artificial gas, but the closer temperature control, reduced spoilage, elimination of fire and explosion hazards, possible decrease of labor costs, and other advantages will frequently throw the balance in favor of the electrical method. —*Chemical and Metallurgical Engineering*, October, 1925.

Electrophysics, Electrochemistry and Batteries

Mechanical, Thermal and Optical Properties of Fused Silica.—ELIHU THOMSON.—By fusing rock crystal in an electric vacuum furnace clear masses of silica, reasonably free of bubbles, are obtainable. The scale of operations may be enlarged so that pieces many pounds in weight result. Where a clear, transparent product is not essential fairly pure silicious sand can be used as the raw material. Some of the notable properties of fused silica follow: High elasticity, with almost negligible internal work when vibrating as in a tuning fork, and therefore very slight damping; possibility of grinding, as by a carborundum wheel, without danger of fracture by unequal heating; extremely low temperature coefficient, 518×10^{-9} at 200 deg. C., or about one-seventeenth as great as for platinum, so that metals can be cast into openings in the mass without breakage by the sudden heating; absence of drift after heating or application of stress, making it useful for thermometer tubing and fine instrument suspensions. Possible future uses are: insulators for high-voltage lines, singly capable of standing 200,000 volts or more; condensing lenses for projection apparatus (index of refraction for the D line, 1.459; crown glass, about 1.52); silvered disks for reflecting astronomical telescopes, replacing glass; parts of scientific instruments where constancy of dimensions is important. The transparency to short wave lengths, far in the ultra-violet up to about 2,000 angströms, suggests various physical and physiological uses.—*Journal of Franklin Institute*, September, 1925.

Steel Castings and X-Rays.—ANCEL ST. JOHN.—The author is making a quantitative study of the size of cavity which can be detected in various thicknesses of the metals commonly used in castings. In the tests here reported 100 sheets of transformer iron were piled together, aggregating 1.4 in. in thickness. Holes were drilled through varying numbers of the sheets, constituting cavities of greater or less depth. A hole in one sheet with a No. 1 drill is just observable; likewise a No. 60 hole through sixteen sheets. The author concludes that fluoroscopic observation, eliminating the cost of photographic methods, would without difficulty detect isolated defects having a diameter as small as one-tenth the thickness of the part in question, under the most unfavorable conditions that would be met in actual practice.—*Iron Age*, Sept. 24, 1925.

Traction

Railway Rectifier Plant.—C. BRYNHILDSEN.—The Berner Oberland railroad, operated electrically since 1913, gave in 1920 permission to a large Swiss manufacturing firm to install two experimental mercury-arc rectifier sets in its main substation, otherwise equipped with motor generators. The railway operates with 1,550-volt direct current, deriving its power from the 7,000-volt, 40-cycle Jungfrau three-phase system. An 800-kva. star-hexagonal transformer was provided for the rectifiers. For two and one-half years tests were made with these sets, supplying the railroad either alone or in parallel with the motor-generator sets and the storage battery. Their operation proved to be so simple, reliable and economical that the railway decided to install a permanent and modern rectifier of 650 kw., 420 amp. and 1,550 volts and to retain two of the old 240-kw. motor-generator machines as spares. A complete wiring diagram of the present substation shows how the rectifier, motor-generators and battery are arranged to give flexibility of operation and an absolutely reliable supply of energy to the railway.—*Brown, Boveri Mitteilungen*, October, 1925.

Telegraphy, Telephony, Radio and Signals

Broadcasting Receiving Apparatus.—W. L. MCPHERSON.—A recent exhibition affords opportunity for describing current types of receiving apparatus of British manufacture. Among the newer features mentioned are the gen-

eral use of thoriated filament valves, neutrodyne and supersonic circuits, resistance coupling on the audio side with valves of adequate capacity and having high amplification factors—on the order of fifteen or twenty—in connection with large diaphragm hornless loud speakers, the more general use of grid bias in these tubes and improved appearance of the sets considered as home furniture.—*Electrician (England)*, Sept. 25, 1925.

Influence of Rectifier Plants Upon Telephone Lines.—A. ZASTROW and E. R. BENDA.—If overhead telephone lines run parallel to direct-current railroads which derive their current from mercury-arc rectifiers very pronounced induction phenomena will be noticed in the telephone receivers on account of the "wavy" character of the rectified current. The author studied this problem first mathematically and later by analyzing the telephone currents with an oscillograph. The interference is particularly disturbing because the induced alternating current lies within audible limits of ordinary speech. A simple and effective remedy for this trouble has been found by a combination of a choke coil and a condenser, the two forming a wave filter.—*Elektrotechnische Zeitschrift*, Sept. 24, 1925.

Miscellaneous

Electric Logging.—P. A. WICKES.—*Steam Logging.*—JOSEPH W. GILL.—These are companion papers, illustrated, describing two methods of logging used in the Northwestern States. Each presents data on construction, power consumption and output. Those on steam operation are particularly full.—*Mechanical Engineering*, October, 1925.

Electric Mine Lamp.—M. MATHIVET.—Fully three-quarters of the coal miners in France working in firedamp territories are today carrying electric hand lamps. An extended investigation of the performance and economy of the three most-used types of lamps is recounted in this paper. The competition between lead and nickel storage batteries is not yet settled. It was found that the manufacture of lead cells is much simpler, their cost 30 per cent less and their life one-third of the nickel type. Comparative tests on a large scale and in the mine would be the only safe means to state definitely which type is the preferable one. Of the investigated lamps the type called "F.A.M." is remarkable in many ways. It is a lead cell with gelatinized sulphuric acid contained in a metal-surrounded rubber cylinder. Cover, leads and gas vent are absolutely tight, permitting operation of the lamp permanently in an inverted position. The lamp cover is locked magnetically and can be opened only by holding the entire lamp against a specially shaped magnet. A very strong cage giving the least possible obstruction protects the glass-inclosed 2-cp. bulb. The lamp weighs about 2½ kg. and supplies useful light for fifteen hours. The cell is guaranteed to give a life of 800 discharges.—*Bulletin de la Société Française des Electriciens, No.* 44, 1925.

New Books

The Chemical Action of Ultraviolet Rays

By C. Ellis and A. A. Wells. New York: Chemical Catalog Company, Inc. 362 pages, illustrated.

Ultraviolet rays and their effects have stimulated popular imagination in many ways, and this authoritative treatment of the subject is a timely contribution. Ultraviolet rays have proved important in developing the dye industry so as to get fast colors; they have aided in the bleaching of oils and have had an important influence on chemical processes such as the synthesis of carbohydrates and proteins, and they have helped create vitamins in food products.

All these topics are treated, and in addition the death ray, so often spoken of in the newspapers, and the possibility of synthetic foods and the transmutation of metals are discussed. Above all, the authors show that ultraviolet radiation has a very important place in the instrument file of the chemist and can aid him in the synthesis and decomposition of substances. But its limitations as well as its possibilities should be known, and these are well outlined in this text. The engineering element of the book deals largely with the production of these rays, with protection against them and with certain engineering applications.

Piles Primaires et Accumulateurs

By Ch. Féry, Ch. Chéveneau and G. Paillard. Paris: J. B. Baillière et Fils. 684 pages, 292 illustrations.

Compared with the efforts made during the last century, very little investigation has been made in the last twenty years to find new voltaic combinations for primary cells. Even in the construction of storage batteries only minor improvements have been accomplished. The sweeping introduction of machine generated and distributed current was, of course, responsible for this; but there still remain vast domains where the primary cell not only rules supreme but where its dominance assumes growing importance. This fact may best be illustrated by statistical data disclosing that, for example, in the United States two million dry cells were sold in 1889, a figure which rose to seventy million in 1914 and passes one hundred million today. The French output of dry cells for 1920 was valued at $20,000,000.

A complete and coherent story of the history, development and present status of this branch of electrical industry is the basis of this book. Every useful voltaic cell ever devised is recorded in this volume with its exact electrochemical theory, explaining its more or less perfect depolarization. The various attempts at designing thermo-electric cells have a chapter to themselves. An account of the gradual development of the dry cell, now so extensively used, covers twenty-eight pages, containing full descriptions of the most successful types.

The second half of the book is devoted to storage batteries, from Planté's original construction to the most modern types. Appended to this part of the work is a chapter dealing with charging devices for storage batteries from alternating-current sources. The authors use a very valuable method to show the actual performance of primary and secondary cells by reproducing diagrams drawn by recording voltmeters and ammeters during the discharge of the cells. The painstakingly compiled book is one of the best contributions in this field of electricity, being written by three men who themselves have contributed many a valuable addition to primary and storage cell design. A. P.

Book Notes

Physics. By L. B. Spinney. Third edition. New York: Macmillan Company. 632 pages, illustrated.

This splendid text on physics has been thoroughly revised and is especially valuable to electrical engineers because it devotes so much attention to electrical and allied science. It is practical in viewpoint and contains a sound fundamental treatment of mechanics, electricity and magnetism, heat, sound and light. The illustrative problems at the end of each chapter have been carefully selected to bring the theoretical contents into play for their solution.

National Directory of Commodity Specifications, 1925. Washington: Department of Commerce. Miscellaneous Publications No. 65. 379 pages. Price, $1.25.

This volume contains classified and alphabetical lists and brief descriptions of existing commodity specifications formulated not only by public purchasers throughout the United States, but also by the nationally recognized trade associations, technical societies and public utilities. A section of the book is devoted to electrical machinery and supplies, and under this heading all available specifications are listed in classified form. Subdivisions include generators and motors, transformers, panels and switchboards, conduits and switchboxes, telephone apparatus, etc., and cover a very complete list of apparatus and supplies.

Books Received

Bau Grosser Elektrizitätswerke. By G. Klingenberg. Berlin: Julius Springer. 600 pages, illustrated.

Electrical Engineering Problems. Direct-Current Circuits and Apparatus. By John G. Pertsch, Jr. New York: McGraw-Hill Book Company, Inc. 213 pages, illustrated. Price, $2.

The Dynamo. By C. C. Hawkins, M.A. New York: Sir Isaac Pitman & Son, Ltd. Vol. III. Sixth edition, entirely rewritten and enlarged. 572 pages, illustrated. Price, $8.50.

Alternating-Current Circuits. By John M. Bryant and James A. Correll. New York: McGraw-Hill Book Company, Inc. 412 pages, illustrated. Price, $3.50.

Report of the Committee of the, Privy Council for Scientific and Industrial Research. For the year 1924-25. London: His Majesty's Stationery Office. Price, 3 shillings. (Copies may be obtained from the British Library of Information, 44 Whitehall Street, New York City.)

Wörterbuch der Elektrischen Nachrichtentechnik. By O. Sattelberg. Berlin: Julius Springer. 292 pages.

Rewinding Small Motors. By Daniel H. Braymer and A. C. Coe. New York: McGraw-Hill Book Company, Inc. 247 pages, illustrated. Price, $2.50.

Light, Photometry and Illuminating Engineering. By William E. Barrows. New York: McGraw-Hill Book Company, Inc. 412 pages, illustrated. Price, $4.

News of the Industry

Three Muscle Shoals Reports Are Possible

There seems no doubt that the Muscle Shoals Commission will fail to agree on a report. In fact, majority and minority reports are nearing completion, the former to represent the views of Chairman McKenzie, Senator Dial and Commissioner Bower, the latter those of Commissioners Curtis and McClellan. There is a persistent rumor that there are to be three reports, but it is believed that Senator Dial will be content to sign the report on which Messrs. McKenzie and Bower are agreed, so long as he is allowed to express certain additional views.

So far as is known, the majority members of the commission have not conferred with the Secretaries of War, Commerce and Agriculture in the formulation of their conclusions. Commissioners Curtis and McClellan, however, are known to have observed scrupulously that portion of their instructions.

The finishing touches are being put on the majority report by Commissioner Bower and W. G. Waldo, the commission's technologist. It is believed that this report recommends a large subsidy for the operation of the nitrate plants. It is on this point principally that the commission has split. It is thought that Commissioners Curtis and McClellan insist on the separation of fertilizer production and the generation of power. They oppose any subsidy, whether in the form of power or otherwise, for fertilizer production and are unalterably opposed to allowing the government itself to be set up in a fertilizer business.

Boston Municipal Light Plant Order Vetoed

On the ground that the present time is inopportune, Mayor James M. Curley of Boston vetoed last week an order of the City Council to establish a municipal lighting plant in that city, and thus any fears of imminent municipal ownership have been proved groundless. Mayor Curley pointed out to the Council that the arguments against the city's embarking at the present time in the enterprise are so strong as to make it imperative to disapprove the project without regard for political considerations, that the remedy for excessive lighting rates lies in the Department of Public Utilities, and that estimates of the cost of establishing a municipal lighting plant range from fifty to one hundred million dollars.

"If the taxpayers are to be loaded with any more burdens than they are already carrying," said the Mayor, who since the Massachusetts commission's decision authorizing an increase in telephone rates has been hostile to the board and has been seeking a change in its personnel, "it is my opinion that the city's credit should be used for the many pressing necessities to which I have called attention during my administration, rather than in attempting to accomplish something which can be effected by the votes of the people without the expenditure of a dollar."

Institute Meetings for 1926

The board of directors of the American Institute of Electrical Engineers has, on the recommendation of the committee on co-ordination of Institute activities, adopted the following schedule of meetings for 1926: Midwinter convention, New York, week beginning February 8; annual business meeting, New York, May 21; annual convention, probably June 21-25, place to be determined by the committee; Pacific Coast convention, Salt Lake City, date to be decided later; regional meetings: Middle Eastern District, Cleveland, March 18-19; Northeastern District, Niagara Falls, latter part of May or early in June.

Insull Interests Enter North Ontario Territory

According to advices from Sault Ste. Marie, Ontario, the power plant of the Algoma Power Company at Michipicoten Falls, on the Michipicoten River, has been taken over by the Insull interests of Chicago, and further development work, involving an outlay eventually of $4,000,000, will be commenced soon. This is looked on as one of the most significant developments which have recently taken place in the district, for it is thought to indicate that the Insull interests are satisfied that the Algoma mining country has "arrived" and that they desire to be in on the ground floor to supply power to the mines which it is expected will open shortly in the Michipicoten and Goudreau gold districts.

The present development at Michipicoten Falls provides about 2,000 hp., but the plans of the new owners provide for the development of 25,000 hp. This will be available for the whole of the Goudreau and Michipicoten district, as the power plant is only about 6 miles from the Michipicoten gold area and about 25 miles from the Goudreau gold area. The plans provide for the building of a new power house at Michipicoten Falls, where the present head of 128 ft. will be raised to 160 ft. The scheme also includes various control dams along the head waters of the Michipicoten River, the most important storage basin being Manitowick Lake.

Work will be commenced on the engineering end of the new development at once. The whole work may take several years. The price paid for the Detweiler plant is said to be more than $300,000.

Commissions' Decision on Conowingo Not Yet Ready

The problems of interstate regulation of the Conowingo power project were discussed by members of the Pennsylvania and Maryland Public Service Commissions and O. C. Merrill, executive secretary of the Federal Power Commission, in conference at Harrisburg, Pa., on Monday night. The conclusions arrived at by the conferees were not made public because they are to be used, it was indicated following the meeting, in decisions to be handed down later by both commissions.

There is thus far no certainty whether the Susquehanna Power Company's applications for the right to construct the plant at Conowingo will be approved or disapproved. W. D. Ainey, chairman of the Pennsylvania commission, and Harold E. West, chairman of the Maryland commission, suggested after the session that another conference regarding jurisdiction and responsibility of the two states probably would be held later. On the basis of conclusions reached at Monday's conference and the meeting to be held later the two commissions will hand down their orders.

Governor Ritchie of Maryland has gone on record as disagreeing with Governor Pinchot of Pennsylvania in his statement that if energy is delivered at wholesale to a distributing company in the receiving state, then the states, acting each for itself, are powerless to regulate the business in any particular.

"Maryland will have complete regulatory power over the Conowingo development in this state," said Governor Ritchie, "and will be able to get power from it. A Maryland market is available and ready to receive the power, and Maryland will be fully able to regulate rates and service."

Continued Rainfall Bringing Normal Power in South

Continued rainfall, though small in total amount, is gradually building up a reserve supply of water in the reservoirs of the Southeastern hydro-electric companies which, it is believed, will before long make power curtailment unnecessary. The Southern Power Company has eliminated one-half day from its curtailment program in the Carolinas, making two days a week curtailment now instead of two and a half.

On November 3 all power customers of the Georgia Railway & Power Company were notified that normal service was possible, complete restoration being aided by the inauguration of the Yonah plant as noted last week. Water storage at this new plant will amount to 350,000,000 cu.ft., and the Nacoochee plant when it is built will provide as much more.

Supply Manufacturers Would Consolidate

Statistics and Label Service Under Discussion at New York Convention—Governor Trumbull of Connecticut and Gerard Swope Speak

CONSOLIDATION of the two principal manufacturers' associations of the electrical industry now seems assured by the action of the Associated Manufacturers of Electrical Supplies, in convention this week at the Hotel Roosevelt, New York City, in indorsing the principle of a combination of this organization with the Electric Power Club and the appointment of a committee to work out plans for bringing it about in co-operation with the similar committees already appointed by the Electric Power Club and the Electrical Manufacturers' Council. In a very thorough presentation of the purposes of such a reorganization President William H. Thornley pointed out the obvious weakness of the manufacturing branch of the electrical industry in influencing national issues so long as the manufacturers are separated into group associations. While acknowledging the present co-ordination through the Electrical Manufacturers' Council, he maintained that one united body could accomplish more.

The subject of the relationship between the manufacturing industry and the Underwriters' Laboratories was discussed at length in the general meeting held on Tuesday afternoon by S. L. Nicholson, chairman of a committee that has been established as a liaison between the two. This committee has been investigating the cases of delay or difficulty in the affairs of the various sections of the association and the laboratories and is working toward a solution of the entire problem of the function which the laboratories should perform. The question of the label service on approved products has long been under criticism and is being carefully studied. In one line, for example, Mr. Nicholson said the use of the labels has decreased from 85 per cent of the volume of this product to 15 per cent, and the whole status of such approval is, of course, affected. The association has instituted a supervised service for establishing uniform cost accounting among its members looking toward the development of industry statistics.

At the banquet on Tuesday evening Governor John H. Trumbull, of Connecticut, himself a member of the association, in an intimate talk told how business principles are being established in state government by the simple institution of the "pay as you go" policy controlled by a budget operation as practiced in industry. Gerard Swope, president of the General Electric Company, in an address on the status of the electrical manufacturing industry, discussed the relationship between the large and small manufacturers. Production in the electrical industry, he said, is divided among a very large number of manufacturers as compared with many other large industries, the largest single company—the General Electric—controlling but 23 per cent of the business. There need be no danger to the small manufacturer from the activities of the large, for these great organizations are made up of the same kind of men as the small companies—men desiring friendship, respect and achievement in the human way. Because of their greater facilities the large firms are in a position to contribute more greatly, as in research, for example, where much work is done for pure science and contributed for progress in which ultimately all benefit. The industry can better stand the competition of large companies that are highly organized and are making money than the competition of small companies that do not know their costs.

The first presentation of the James H. McGraw award to the manufacturing branch of the electrical industry was made by Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD. The bronze medal and purse were awarded to S. L. Nicholson, with honorable mention to T. E. Barnum and C. A. Bates, as is described in detail or page 1024.

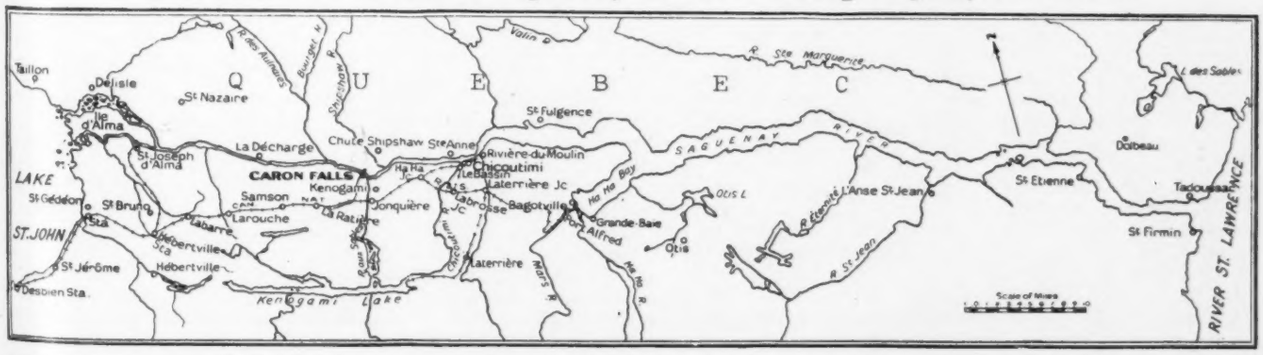
Cleveland Votes Money for Its Municipal Plant

By a vote of two to one the people of Cleveland approved on November 3 a half-million-dollar bond issue for the city's municipal light plant. The bond issue for the plant was carried along with six other larger bond issues for other municipal purposes.

The Cleveland *Times* vigorously opposed the bond issue. In a pre-election editorial the Cleveland *News* said: "Using the public credit to borrow millions for unnecessary spending on a superfluous electric plant and a hopeless additional experiment in municipal ownership always looked silly to us. We said so emphatically in 1911, when it could have been prevented. The competition afforded by the city plant appears particularly foolish with the great Cleveland Electric Illuminating Company providing the whole community with service both admirable in quality and reasonable in price, while dealing so honorably with the public that Clevelanders consider it part of our city government—not a utility corporation. But the city light plant is like the government merchant fleet. We have it whether we want it or not. The problem is to get rid of it with the least possible loss. Rather than cripple or dismantle it for lack of a half million for betterments, we advise citizens to vote the money."

Voters of Berea, Ohio, a town of 3,000 population in Cuyahoga County, approved a bond issue for $65,000 for the purpose of improving their municipal light plant.

Vast Water Power of the Saguenay River Is Being Rapidly Harnessed



THIS map, prepared by the Natural Resources Intelligence Service of the Canadian Department of the Interior, under the direction of Minister Charles Stewart, shows the Saguenay River district of Quebec, which within the last two years has become the scene of a number of very important industrial developments. At the Grand Décharge the Duke-Price interests have recently completed a 360,000-hp. hydro-electric plant, while at St. Joseph d'Alma Price Brothers are erecting a newsprint mill with a daily capacity of 200 tons. At Port Alfred the Port Alfred Pulp & Paper Company is erecting a pulp mill of 100 tons daily output. These mills depend on hydro-electricity for their power. At Caron Falls the Aluminum Company of Canada is constructing a hydro-electric plant with a capacity of 800,000 hp., to be followed by an aluminum plant which, it is said, will employ from five thousand to six thousand hands. In the immediately adjoining territory the Chicoutimi Pulp Company has a mill at Chicoutimi, while Price Brothers have pulp and paper mills at Kenogami and Jonquière.

Engineers Hear About Energy from Subterranean Heat

Three papers dealing with the derivation of energy from beneath the earth's crust were presented on Thursday evening of this week before the United Engineering Societies in New York City. L. P. Breckenridge, professor of mechanical engineering at Yale University, took for his topic "Subterranean Heat as a Source of Energy"; Frank A. Perret of Hartford, Conn., well-known volcanologist, summarized the results of his comparative study of the various forms of volcanism as sources of power, and J. D. Galloway, consulting engineer, San Francisco, told of the development of natural steam wells at the California geysers, where it is hoped to generate 50,000 kw., as recounted in last week's ELECTRICAL WORLD (page 963).

John W. Lieb, vice-president New York Edison Company, prepared an introduction for Professor Breckenridge's paper in which he referred to the natural-steam power plant established at Larderello, in Italy, in 1904, by Prince Ginori Conti. This plant was described in detail by Professor Breckenridge, whose paper was illustrated with lantern slides.

Pacific Gas & Electric Corrects Erroneous Statements

Two misstatements which have been repeatedly made in relation to the arrangement under which the Pacific Gas & Electric Company is distributing Hetch Hetchy electric power for the city of San Francisco are corrected in an official statement just put out by that company. One is that the company gets 24 per cent of the power for nothing. The other is that the company is making a tremendous profit because of the difference between the amount collected by the company as the city's agent and the sum paid to the city. It is even asserted that this difference is all profit.

"The Pacific Gas & Electric Company gets no Hetch Hetchy power for nothing," says the company's answer. "It is an elemental fact that electricity cannot be handled without some loss of energy; one might as well expect the iceman to deliver to consumers as much ice as he started out with. That 24 per cent represents energy lost in transmission and distribution between the Newark substation and the meters of San Francisco consumers. This figure was agreed upon by the contracting parties because the company's reports for 1924, filed in obedience to law with the State Railroad Commission, show that the Pacific Gas & Electric Company actually put 24 per cent more electrical current on its San Francisco wires than it sold to consumers or used for its own purposes.

"As for the second misstatement: The temporary contract between the city of San Francisco and the company provides that 26.935 per cent of the moneys received in the distribution of power shall go to the city and 73.065 per cent to the Pacific Gas & Electric Company, such return to be based on a rate of 2.383 cents per kilowatt-hour, which was the company's average return in San Francisco for all kilowatt-hours of energy sold in 1924. That same year the company's net return, on the rates fixed by the Railroad Commission for the various communities of northern and central California, was 7 per cent on its actual investment in properties used in the creation, transmission or distribution of electricity. The mere fact that it is now distributing Hetch Hetchy power in place of an equal amount of its own power cannot transform a 7 per cent return into an enormous profit."

San Francisco Favors Municipal Distribution System

By electing nine Supervisors of the "minority group" ticket at the municipal election last week San Francisco voters apparently expressed disapproval of the sale of hydro-electric power from the Hetch Hetchy municipal project to a private corporation for distribution in the city. This group in its platform opposed the contract recently entered into between the city and the Pacific Gas & Electric Company and favored acquisition of a municipally owned distribution system.

Pool New England Powers, Says Young

Maintenance and Development of High Standards of Living Demand Maximum Power Resources per Worker—State Lines Artificial Barriers Only

"CREATE a New England power pool and draw from that mobilized supply, through adequate integrated transmission systems, the power you need for your industry at the most economic point of production," was the message of O. D. Young, chairman of the board, General Electric Company, scheduled for presentation on Thursday of this week before the New England Conference of Governors and Delegates at Worcester, Mass. The address emphasized the vital economic importance of power development as an aid to industry and as a necessity of high-grade civilization. On the more general and nation-wide economic aspects of power utilization Mr. Young said, among other things:

"One of the economic guarantees of a high wage level is to put more power back of the individual worker. We must use human beings more and more to direct and control power rather than to generate it. The wage curves of the principal countries in the world follow closely their power development curves. That is to say, wherever you find a high wage level you also find a large supply of power back of the worker. In China man power is still used for transportation and many other purposes. The wages are so low that the capital cost of generating power from other sources and applying it to men's needs is unprofitable. They have an abundance of cheap labor and only a limited supply of capital, the cost of which is high. Therefore, you find low wages, little power development and living conditions unthinkable in America. Our situation is exactly the reverse. We have a limited supply of high-priced labor and an ample supply of cheap capital widely distributed among our people. We have used this capital to put power back of the worker until today we have a larger amount of power available to each wage earner than any other country. . . .

"AWAY WITH NONSENSE"

"I know that the term 'power pool' is an attractive political catchword. Unscrupulous men take advantage of it and picture it as a great monster crouching to devour all men, women and helpless children within its reach. Let us be done with this nonsense, because, in fact, it is a great servant and is subject, as it should be, to government control. Is America afraid to use great tools in her own interest merely because, uncontrolled, they would have power to injure? One would think to hear many of the comments made that this pooling idea, in order to take advantage of diversity, was something new and untried in the business of America. That is not so at all. The business of our great insurance companies is based on that element of diversity. Our great banks are founded on it, and the service which they render to the community is made possible entirely because of the factor of diversity. All persons insured do not die at the same time—all fires do not take place at the same time—all persons having deposits in a bank do not withdraw their money at the same time—all motors and lights do not go on at the same time. The pool of funds in our banks and insurance companies furnishes the community with its liquid capital supply and, at the same time, it is available for the ordinary needs of the individuals who furnish it. That service is made possible through diversity.

"My suggestion is that we mobilize our power as intelligently as we mobilize our money and handle it as wisely in the interest of the whole community. If all of us kept our money in our pockets, it would be working only when we used it. When we put it in the banks we keep it working during the interval when we, as owners, do not need it. That is exactly the condition of localized powers, whether steam or water. The moment we tie them into a common system of transmission, they are made available for use when the local needs do not require them. The old feeling that the community in which a power exists is entitled to its exclusive use, however uneconomic that use may be, must be eliminated. That does not mean that the local community has no advantage from its power location—it has. Power is the cheapest at the point of its generation. It grows increasingly expensive with the distance of its transmission. Therefore, the local community has the preference, and

rightly so, on its own power. That is all it needs."

Mr. Young, coming back to a discussion of the special power situation found in the New England States, showed the fallacy of the idea that energy should not be exported beyond state lines, these being merely artificial barriers, and pictured an ideal arrangement in which the six states would unite, under joint commissions, in the unification of laws for the development and transmission of power, whether from hydro or steam plants. In falling short of the full and economical use of her joint power resources New England, he said, lacked the leadership she has always given to the nation as a whole.

Alabama Power Company Gets License for Coosa River

Concurring in an order issued on August 7 by the Alabama Public Service Commission, the Federal Power Commission announced on Monday in Washington that it had granted to the Alabama Power Company a license to construct a dam and power house near Wetumpka on the Coosa River at the site known as Lock 18. The technical details of the development were described in the ELECTRICAL WORLD for October 17 (page 795). Much preliminary work on the site has already been done, and the company announces that the clearing of the basin will begin soon. The estimated cost of the plant will be about $13,000,000. The ultimate installation will be about 160,000 hp. in five units, of which two will be installed to begin with.

Radio Conference Adopts a Legislative Program

Emphasizing the interstate character of radio communication, Secretary Hoover put before the fourth national radio conference, when it met in Washington on Monday of this week, a plan for a national policy that would give the federal government full power to control traffic and wide authority in policing interference, leaving to local communities a large voice in determining who are to operate broadcasting stations. The Secretary later in the week, in accordance with a resolution passed by the conference, announced that no new broadcasting stations would be licensed at this time.

Recommendations were made that in supervising radio the authority of the Secretary of Commerce should be limited to the issuance of licenses to broadcast, the control of power, the assignment of wave lengths and other appropriate measures applying to the interstate and international situation. It was expressly stipulated that governmental authority should not be extended to mere matters of station management.

Recommendations made by the conference which are of especial interest to light and power utility companies are those opening the band of wave lengths from 85.7 m. to 105 m., the recognition of broader point-to-point bands, and the relief of licensed operators at certain specified types of station from the requirement of listening in and from the necessity of being able to send or receive telegraphic code. These recommendations have obviously an important bearing on "wired wireless" communication. The work of the National Electric Light Association received cordial recognition from the conference.

Commercial Men of Wisconsin Association Meet

How to make electric and other service more useful to the public was the theme of the convention of the Commercial Section of the Wisconsin Utilities Association, which met in Madison on November 12 and 13. A display of modern labor-saving devices was made by electrical manufacturers at the Hotel Loraine. The program included Chairman W. R. Lacey's report on the activities of the section during the year, a talk on home service by Mrs. Katherine Delaney of the Wisconsin Public Service Corporation, the report of Robert E. Steele, chairman of the industrial lighting committee, and an address by Don E. Mowry, secretary of the Madison Association of Commerce, on "Should Public Utilities Sell Merchandise That Does Not Use Gas or Electricity?" Frank V. Birch of Milwaukee spoke on public relations.

Edison on the Aspirations of a Public Utility

In response to a letter from Herbert B. Flowers, president New Orleans Public Service, Inc., Thomas A. Edison sent him a letter containing the following message for broadcasting on the anniversary of the birthday of the incandescent lamp on October 21:

"You ask for my ideas of what the aspirations of a public utility should be. They can be stated in very few words:

"First — It should constantly use every endeavor to reduce the cost of production of its commodity and sell it to the public at the lowest possible price consistent with the making of a reasonable profit on its investment.

"Second—To regard the public as a partner and, as such, entitled to know the salient facts of its business.

"Third—It should lay all its cards on the table and play fair and square.

"It seems to me that if these ideas were carried out, our public utility corporations would escape many troublesome investigations and harassing restrictions."

National Power & Light Gets Carolina Company

The National Power & Light Company is to acquire substantially all the common stock of the Carolina Power & Light Company under a plan announced this week by the Electric Bond & Share Company, which is fiscal agent for both companies. The plan calls for the exchange of fifteen shares of National Power common for each share of Carolina Power common.

The chief operating subsidiaries of the National Power & Light Company are the Arkansas Central Power Company, Birmingham Electric Company, Houston Lighting & Power Company, Memphis Power & Light Company, Knoxville Power & Light Company and Jackson (Tenn.) Railway & Light Company. The Carolina Power & Light Company operates the entire electric power and light, street railway and gas service in Raleigh, besides supplying electric power and light at retail and wholesale rates to other communities. It controls the Yadkin River Power Company and the Asheville Power & Light Company.

Before the Federal Power Commission

The Enconfina Power Company has applied to the Federal Power Commission for a preliminary permit covering a power project on Enconfina River, 14 miles north of Lynnhaven, Fla. It is proposed to build a dam 30 ft. high and 3,000 ft. long. The reservoir will cover 740 acres. The project will develop 1,500 hp. of primary power, to be used for public utility purposes.

The Chief of Engineers finds that the proposed power project of the New River Development Company in New River, 3 miles above Radford, Va., will affect the navigable reaches of the Kanawha River, of which New River is a part. For that reason he finds that federal rights will have to be obtained. The power company has taken issue with the finding of the engineers. It contends that the operation of the project along the lines it proposes will not affect the navigation of the Kanawha. The contentions of the company now are being considered by the commission.

General Taylor on Preservation of Niagara Falls

The Corps of Engineers of the United States Army is in a position to report promptly on the character of work necessary to halt the recession of the crest of Niagara Falls, General Harry Taylor, the Chief of Engineers, asserts. It is his conception that this work should be under the general direction of the Niagara Control Board, and he will be glad to place the services of the district engineer at Buffalo at the disposal of that international body. So much study already has been given the problem that a formal survey would require only a short time.

Before anything can be done toward halting recession an agreement must be ratified by Canada and the United States. After the agreement has been ratified Congress will have to authorize the survey and appropriate for it. It then will be necessary to secure additional legislation for the construction of the project itself. The slowness with which international affairs move and the delays incident to legislation are such that more than 25 ft. of additional recession is not unlikely, it is thought, before the erosion can be retarded. A recent airplane survey of the brink shows that 55 ft. of recession has taken place since 1917. The rate of erosion is increasing progressively as the water is forced more and more into the gorge it is wearing.

Farewell Dinner Given to Delegates from France

Speaking at a farewell dinner tendered at the University Club, New York, to the members of the delegation of French electrical engineers and executives who, after a rapid but comprehensive tour of this country, sailed last week for home, Albert Petsche, president Union d'Electricité of Paris, who headed the party, said as interpreted by J. W. Partridge, one of his colleagues, who is engineer in chief of the lighting section of the Public Works Department of Paris:

"In France the long war and after-war period set back several years the development of domestic uses of electricity. It has been resumed at a very rapid rate, gaining each year from 25 to 30 per cent. The number of consumers of electricity in Paris is still but half what it could be, and our development must meet the demand resulting not only from the increase in the number of customers but also from the increase in the consumption of the average customer. Our consumption of electricity per capita is about one-half of yours. With an accelerated rate of development we hope, if not to do as well, at least to diminish that difference. We are already endeavoring to develop the use of electrical domestic appliances, of electrically driven vehicles and electricity on the farm.

"Our legal and financial standing is quite different from yours. Our companies exist usually by virtue of short-term licenses, and we must set up large sinking funds. In spite of this our rates have but doubled, while paper francs are down to one-quarter their face value. It means that the price of energy, reckoned in gold francs, is but one-half the pre-war price and usually less than the price you charge. That situation is hampering our efforts, and if the progress we have made in the technical and scientific aspects of central-station engineering is not far from yours, we must give close attention to simplicity and economy and we cannot afford the elaborateness and even luxury of your stations."

Maurice Saurel, J. E. Aldred, Michael I. Pupin and M. S. Sloan were other speakers. The spokesmen for the visitors referred appreciatively to the attention and courtesies shown them everywhere in the United States. Anson W. Burchard, chairman of the board of the International General Electric Company, was toastmaster, and about eighty leading American light and power men were present.

Crawford Avenue Unit No. 4 to Produce 75,000 Kw.

Excavations and foundation footings for the next turbo-generator at the Crawford Avenue station of the Commonwealth Edison Company, Chicago, are complete, and concrete for the main foundations is now being poured. This General Electric unit will be larger by one-fourth than any now on the company's system. It will have a capacity of 75,000 kw. and will be one of the largest steam-driven generators in the world. With the addition of this unit —No. 4—Crawford station will have a rating of 235,000 kw., or 5,000 more than Fisk, which has long ranked as the company's largest station.

The new machine will be divided into two elements, the high-pressure element, having a rating of 28,250 kw., and the low-pressure end, rated at 46,750 kw. The high-pressure shaft will also carry a 2,000-kw., 2,300-volt auxiliary generator. The two 12,000-volt oil switches for the new generator will have a carrying capacity of 5,000 amp. each and are believed to be the largest oil switches in existence for this voltage.

Five standard boilers will supply the steam. No reheating of steam between stages will be done as the additional investment necessary is not warranted unless the unit is to operate under base-load conditions. The present three units at Crawford with their reheat equipment are sufficient to handle the present base load. It is hoped to have Unit No. 4 in service by August, 1926.

West Virginia Utility Men Meet

Value of Public Good Will Won by Efficient Service Emphasized by Speakers Who Deal with This Topic in Its Various Ramifications

ABOUT two hundred representatives of electric light and power and other public utility companies assembled at the Kanawha Hotel, Charleston, W. Va., on Friday and Saturday, October 30 and 31, for the eighth annual convention of the Public Utilities Association of West Virginia. The retiring president, Mentor Hetzer, president of the Moundsville Water Company, in his address, emphasized the importance of good public relations. When the best service is given rates will take care of themselves, he said. Secretary A. Bliss McCrum defended the acquisition of smaller plants and systems by larger ones as being, not a squeezing-out process, but in the interest of public service.

C. E. Robertson, manager of the investment department of the Virginia-Western Power Company, Clifton Forge, Va., read a paper on "Customer Ownership—Its Benefits to the Utility and the Public." In offering stock to the public care should be taken, he said, to see that the investment is worth dollar for dollar. It is not to be put forth as an inducement to speculation. Mr. Robertson maintained that the stock of electric power companies is second in merit and safety only to the government's securities.

N. W. Storer, consulting engineer of the Westinghouse Electric & Manufacturing Company, discussed "The Present and Future Status of Railway Electrification," dwelling particularly on the desirability of smoke elimination and of overcoming the difficulty of ascending heavy grades in mountainous regions. On such grades, he pointed out, electricity increases train capacity and centers control in one man, the motorman.

Warren R. Voorhis, vice-president American Water Works & Electric Company, New York, spoke on "Responsibility," stressing the duties of utility companies; J. N. Shannahan, ex-president American Electric Railway Association, discussed the modernizing of the electric railway, and W. S. Vivian, chairman of the public speaking committee of the National Electric Light Association, spoke on "Good Public Relations Our Best Asset." Mr. Vivian spoke also at the banquet on Friday evening, as did D. L. Gaskill, secretary of the East Central Division N. E. L. A., and Governor Gore of West Virginia. The Governor congratulated the utility men on their achievements.

Three or four brief addresses were made at the closing session on Saturday morning. C. E. Wildoner, safety engineer of the Ohio Valley Electric Railway Company, Huntington, W. Va., discussed modern safety work and called for public-school instruction about safety methods. Dr. Enoch H. Vickers, dean of the department of economics and sociology, West Virginia University, paid a tribute to the idealism of public utility companies as expressed at the convention. Discussing the value of service clubs in utility organizations, W. A. Buchanan, assistant district manager of the Kentucky & West Virginia Power Company of Logan, W. Va., said that if a company desired to stress the efficiency of its service it needed to educate its employees in order to convince the public. Round-table discussions followed the presentation of the papers.

NEW OFFICERS

Officers chosen for the new year are: President, W. R. Power, Huntington, general manager Consolidated Power & Light Company; vice-presidents, J. D. Whittemore, Fairmont; A. M. Hill, Charleston, and C. S. Dawson, Charleston; treasurer, Harry L. Gardner, Charleston; secretary, A. Bliss McCrum, Charleston (re-elected). Charleston was chosen as the place for next year's convention.

Electrical Credit Association to Meet Next Week

The annual meeting of the Electrical Credit Association, Central Division, will be held at the Hotel La Salle, Chicago, on November 19 and 20. At the annual dinner Secretary Frederic P. Vose will review briefly thirty years of co-operative credit service. Charles H. Crennan, economist of the Continental and Commercial National Bank, Chicago; J. H. Taylor, credit manager Benjamin Electric Manufacturing Company, Chicago; O. J. Matthews, resident manager credit insurance department, London Guarantee & Accident Company, New York, and Lawrence W. Davis, general manager Association of Electragists International, will be among the speakers at the sessions.

Briefer News

Opening of Columbia Station Postponed.—Dedication of the new Columbia power station at Miami Fort, near Cincinnati, originally set for November 12, has been postponed to some time early in December.

Wyoming Central-Station Company Growing.—The Midwest Public Service Company, with headquarters at Casper, Wyo., is now supplying electric service to Riverton and Worland, Wyo., and is wholesaling energy to the towns of Hudson and Shoshoni. It is understood that the company has options on several Montana and Idaho central stations.

Consolidation in New Orleans Proposed.—An ordinance before the Commission Council in New Orleans provides for the amalgamation of the recently merged Citizens' and Consumers' Light & Power companies with the New Orleans Public Service, Inc. An investigation of the proposal with the special object of determining what the rate base should be is to be made by the Council before it passes upon the plan.

Indianapolis to Have Industrial Heating School.—A committee on industrial heating for the Indiana Electric Light Association has recently been formed under the chairmanship of J. E. Nelson of the Merchants' Heat & Light Company, Indianapolis. Its first activity will be the fostering of an industrial heating school to be held in Indianapolis, November 17 to 19, under the direction of W. S. Scott of the Westinghouse Electric & Manufacturing Company.

Educational Activities of Northwest Association.—The Public Relations Section of the Northwest Electric Light and Power Association has arranged for speakers from the power companies to present a series of subjects throughout the year to students in electrical engineering and business courses at the Washington State College, Pullman, and the University of Idaho, Moscow. Under this plan talks on rates, regulation, franchises and financing will be made by officials of Northwest companies well fitted to discuss them.

District Electric Conference at Muskogee, Okla.—Among topics put before the Eastern District conference of the Electric Light and Power Division, Oklahoma Utilities Association, held at Muskogee on November 5, were "Electrical Development in Coal Fields," presented by G. W. Skow, McAlester, vice-president Southwest Power Company, and "The Pennsylvania Peril," by J. H. Buell, Tulsa, vice-president Oklahoma Power Company. W. H. Crutcher of Muskogee was elected chairman for the ensuing year and J. A. Whitlow of Tulsa was elected secretary.

Julia Groo's Prize House on Exhibition.—Through the courtesy of Julia Groo of Portland, Ore., who won the national home-lighting contest for young scholars last year, the fifteen-thousand-dollar prize home awarded to her was thrown open to the public as an electric home exhibit on November 1. Thousands of visitors have inspected it. This is the first electric home publicly displayed in Portland. It contains almost every possible electric convenience, including complete equipment for heating electrically.

Public Service of Colorado Acquires Plant Serving Mines.—Acquisition of another small property in Colorado is announced by Clare N. Stannard, vice-president and general manager of the Public Service Company of Colorado, which has purchased the power-generating facilities and distribution plant of the Tonopah Placers Company, operating in and around Breckenridge, Col., the heart of the placer-mining industry of the state. Several dredges with a heavy power consumption are now operating in the district, and the prospects for a revival of this form of mining are considered unusually good.

Consolidated Company of Baltimore Dedicates Radio Station to the People.—"WBAL," the new superstation for radio broadcasting erected by the Consolidated Gas, Electric Light & Power Company of Baltimore and placed at the service of that city and the State of Maryland, gave its inaugural program on November 2. Herbert A. Wagner, president of the company, is shown introducing the station to the radio audience. He said that in the future the company's name might not be heard in the announcements and that the station would not be commercialized. Governor Albert C. Ritchie of Maryland and Mayor Howard W. Jackson of Baltimore spoke on behalf of the people of the state and city, congratulating the company on its public spirit, and a musical program was carried out.

United States Government Enters Herminghaus Case.—Upholding the contentions of the Southern California Edison Company in its case against the Herminghaus heirs, covering the question of riparian rights on the San Joaquin River, the United States government has filed a brief at San Francisco. The government's reserve rental interest in the power project and its desire to protect the public's interests in the matter of power development are the reasons given for its action. An injunction now stands which prohibits the Southern California Edison Company from impounding the waters of the San Joaquin River. If this decision is upheld by the upper court, it is pointed out in the brief filed by the government that any further hydroelectric development will be prohibited and this fundamental source of natural wealth remain untouched.

South Missouri Power Company Changes Hands.—The Missouri Public Service Commission has authorized the sale by W. S. Barnes of all the stock of the South Missouri Power Company to L. E. Green, E. J. Green and the Ozark Utilities Company. The deal involves $250,000, and the property affected includes a plant at Greenfield and transmission lines and distribution systems in South Greenfield, Miller, Everton, Lockwood and Golden City. The Ozark Utilities Company has also purchased the Southwest Electric Light & Mill Company, serving Sarcoxie, Bower Mills and La Russell, Mo., and the plant at Jasper, Mo. The company's new acquisitions will be tied together.

Fergus Falls, Minn., Has Sectional Meeting.—Another sectional meeting was held by the North Central Electric Association in the latter part of October, this time at Fergus Falls, Minn. One hundred and twelve were present, including many jobbers' and manufacturers' agents. President C. S. Kennedy, vice-president and general manager of the Otter Tail Power Company, presided. This meeting took in central and western Minnesota. The next meeting is scheduled for Sioux Falls, S. D., November 30, when O. A. Rofelty, local manager of the Northern States Power Company, will be the host.

Cornerstone Laid at Cherokee Bluffs.—The cornerstone of the Alabama Power Company's dam at Cherokee Bluffs on the Tallapoosa River was laid on Saturday, November 7, in the presence of three thousand guests from all parts of the state. A special train was run from Birmingham and Montgomery. Governor Brandon, Senator Heflin, President A. G. Patterson of the Alabama Public Service Commission and others spoke. The plant will, it is expected, go into service in 1926 with an initial installation of three 45,000-hp. units, making a total of 135,000 hp. Addition of a fourth unit at a later date will raise the capacity to 180,000 hp. (See ELECTRICAL WORLD for September 19, page 580.)

Sands on Value of Merrimac Valley Interconnection.—Speaking recently before the Massachusetts Department of Public Utilities upon the proposed consolidation of the Haverhill Electric Company and the Newburyport Gas & Electric Company and the interconnection of their generating plants, H. T. Sands, vice-president Charles H. Tenney & Company, Boston, and president of the two operating companies named, showed how in the manner proposed a total capacity of 19,250 kw.

would be available to handle a peak load of maybe 11,000 kw., giving ample power even if the largest generating unit were to break down. Mr. Sands estimated that a saving of 25 per cent in fuel costs alone would be effected.

Kentucky Utilities Company Buys Paducah Plant.—Lewis B. Herrington, vice-president of the Kentucky Utilities Company, Louisville, announces that the company has purchased the property of the Paducah (Ky.) Electric Company from Stone & Webster, Boston. The price paid for the stock is quoted as about $1,780,000. The properties include the city light and power plant and transmission lines as well as the city railway company and gas plant. The electric plant has a generator capacity of 6,750 kw. Extensions and improvements will be made and a high-voltage transmission line will be constructed from Paducah to connect with other lines and plants of the company in Kentucky. The plant will also be connected with the lines of the Central Illinois Public Service Company and the Grand Tower generating station.

Expedition to New Youghiogheny Plant.—A party of twenty-five men, representing commercial and industrial interests of Johnstown, Pa., journeyed by automobile through a snowstorm last month to the new hydro-electric plant of the Penn Public Service Corporation on the Youghiogheny River in Garrett County, Md., where two 12,000-hp. turbo-generators have been in operation for some time. Here a 1,400-ft. dam, 86 ft. high, backs up the water for 12 miles, forming a lake of nearly 5,000 acres. A total fall of 437 ft. and the large storage capacity will, the company expects, permit continuous operation of the plant. Three other dams and two additional power houses are eventually to be built.

Rates Increased in Attleboro, Mass.—Because of the action of the United States Supreme Court in granting a hearing in the contract dispute between the Attleboro (Mass.) Steam & Electric Company and the Narragansett Electric Lighting Company of Providence, R. I. (ELECTRICAL WORLD, November 7, page 971), the Attleboro company has announced an increase of 7 mills per kilowatt-hour on all bills rendered after November 2. In a statement to customers President T. C. Fales says that the money realized from this additional charge will be set aside as a special deposit to be refunded each customer in case the decision of the court is in the company's favor. Should the decision be adverse, the increased rate to the company on the Narragansett contract will result in an additional payment of about $50,000 by the Attleboro company for the period between February 1 and November 1, 1925. It is expected that the case, which is of great interest in view of the relation of the contract between the two companies to interstate commerce and the question of the jurisdiction of the Public Utilities Commission of Rhode Island in the matter, will be decided during 1926, briefs having been filed by both companies.

Long Island Lighting Company Gets Another Plant.—Acquisition of a more than two-thirds interest in the East Hampton (N. Y.) Electric Light Company by the Long Island Lighting Company was announced last week. The Long Island Lighting Company has generating stations at eight points on the island, but E. L. Phillips, president, is quoted as saying that it has no immediate plans for linking East Hampton to its system. The present officers of the East Hampton company will continue to administer its affairs. A new company, the Eastern Seaboard Power Corporation, has been formed to take over all the stock of both the Long Island and the East Hampton companies, and its application for permission to do so is before the state commission. The new company is capitalized at $15,000,000 and has its main office in Bay Shore, Long Island.

The Ten-Thousand-Dollar Hurley Prize.—E. N. Hurley of the Hurley Machine Company, who at the N. E. L. A. San Francisco convention last June offered the sum of $10,000 as a prize to the electric light and power company making the most constructive contribution toward the development of more effective methods of merchandising of electrical household appliances by central-station companies, has designated the Commercial National Section of the N. E. L. A. as the organization to develop a plan and carry the contest to completion. The first move of the Commercial Section has been to appoint a committee to draw up rules and regulations, and the next to suggest to Mr. Hurley that the period of the contest be continued to the end of the year 1926, to which he has consented, so as to give ample opportunity for every electric light and power company to compete for this prize. It has not yet been determined whether the prize will go to a single company or whether it will be divided three ways, but the plan committee has been asked to serve and the rules and regulations governing the contest will be made public on or about the first of the year.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

Wyoming Utilities Association—Plains Hotel, Cheyenne, Nov. 16-17. R. E. Bengston, Cheyenne.

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 16-20. Franklin Overbagh, 411 South Clinton St., Chicago.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 19 and 20. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Society of Mechanical Engineers—New York City, Nov. 30-Dec. 4. C. W. Rice, 29 West 39th St., New York.

Empire State Gas and Electric Association, Electric Section—54 West 27th St., New York, Dec. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

American Society of Agricultural Engineers, North Atlantic Section—Schenectady, N. Y., Dec. 10-12. Raymond Olney, St. Joseph, Mich.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Puget Sound Power & Light's New Powdered-Coal Equipment. — In the steam-heating station of the Puget Sound Power & Light Company on Western Avenue, Seattle, the largest steam-heating boiler on the Pacific Coast and what are said to be the two greatest powdered-coal burners in the world have just been installed. The burners feed fuel at the rate of 12,000 lb. an hour to the new boiler, which is 18 ft. wide, 24 ft. long and 40 ft. high and increases the capacity of the entire plant by 25 per cent, enabling it to meet a steam-heating demand of 300,000 lb. of steam an hour. The claim is made that to Seattle engineers was due the first successful applicatjon on a large scale of powdered coal to steam-boiler practice, W. J. Santmyer, engineer in charge of steam heating for the Puget Sound Power & Light Company, having in 1917 begun work where others left off.

Missouri Power & Light and West Missouri Power Company to Be Merged.—Funds to take advantage of an option on the plants of the West Missouri Power Company, obtained some time ago for $4,260,000, will soon be forthcoming to the Missouri Power & Light Company, its stockholders having authorized an increase in common stock from 32,000 to 57,000 shares. The Missouri Power & Light, with headquarters at Mexico, Mo., supplies that place, Jefferson City and New London, Mo., and controls subsidiary companies at Kirksville, Boonville, Higbee, Huntsville, La Plata and Moberly, Mo.; Ardmore, Okla., and Washington Court House, Ohio. The West Missouri Power Company, with headquarters at Pleasant Hill, Mo., serves about sixty communities. The total number for the united companies will be more than 150.

Metropolitan Edison Host at Susquehanna River Station.—Four hundred and fifty business and professional men, members of the chambers of commerce of Reading, York and Middletown, Pa., attended the first public inspection of the Metropolitan Edison Company's Susquehanna River station on Friday, November 6. The Susquehanna River station, as previously reported in the ELECTRICAL WORLD, is a pulverized-fuel plant having an initial unit of 35,000 kw. A second 35,000-kw. unit is now being installed, and provision has been made for an ultimate rating of 200,000 kw. It will operate as a base-load plant for the Pennsylvania-New Jersey system of the Metropolitan Edison and affiliated companies, extending from the vicinity of Gettysburg, Pa., for 250 miles northeast, to and beyond Dover, N. J. The company's guests were taken to and from the plant in special trains and were guests at a luncheon in the turbine room of the station. A large-scale illustration in colors made clear to laymen the salient features of the plant.

Men of the Industry

Lawrence Palk, secretary of the Winnipeg (Manitoba) Electric Company, has been elected a member of the council of the Winnipeg Board of Trade, representing public utilities.

G. Case Geraty, Jr., who was formerly electrical engineer and estimator for the Electrical Contracting Company of Chicago, is now connected with the Chicago office of the Public Service Company of Northern Illinois.

Robert M. Keeney, formerly of the general engineering department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, and for some years heating sales engineer in the Boston office of that company, has been appointed industrial heating engineer of the Connecticut Light & Power Company, Waterbury, Conn.

George F. Grote, who has been assistant division manager for the Illinois Power & Light Corporation at its Galesburg (Ill.) plant for more than a year, has been promoted to be manager of the Missouri Power & Light Company with headquarters in Kansas City.

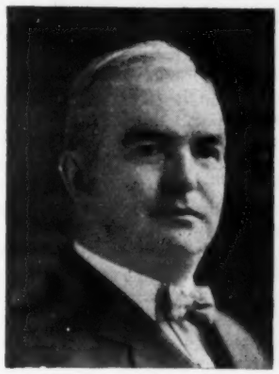
William A. Shoudy, consulting engineer, has become associated with David M. Myers in consulting work in the industrial power-plant field with offices in New York City. Mr. Shoudy has been connected with the design and operation of many power plants and has made extensive studies on combustion engineering subjects.

Holland E. Cox, formerly chief engineer of the Birmingham Electric Company, was appointed assistant general manager on October 27. Mr. Cox was born in Randolph, Ala., and was graduated from the Alabama Polytechnic Institute in 1909, at which time he entered the electric meter department of the Birmingham Railway, Light & Power Company as an installation man. Mr. Cox's service with the company has been continuous with the exception of one year which he spent in the testing department of the General Electric Company in Schenectady. When he returned he did power-station construction work. In April, 1912, he was transferred to the engineering department. At one time he had charge of construction work on substations and other electric construction. Later he was in charge of the steam-heat department. He was appointed chief engineer in February, 1919.

Frank R. Innes, who has been affiliated with the Sessions Engineering Company of Chicago for the past two years, has joined the editorial staff of the ELECTRICAL WORLD as assistant editor. Mr. Innes' early experience was as an employee of the Port Huron Light & Power Company, the Detroit United Railways and the Detroit Edison Company. He served the last-named company in the meter department, as high-tension meter inspector, in the distribution engineering department and later assumed editorial duties on the *Synchroscope*, the company's house organ. He severed his connections with the Detroit utility in 1923 to join the Sessions Engineering Company and has been connected with the Portland (Ore.) office of that organization since the end of that year. Mr. Innes was the inventor of the vectorial addition mechanism now in use in the Westinghouse type RI meter and of other electrical devices.

W. J. Reagan and G. H. Stack Assume New Duties in Utica

William J. Reagan, new vice-president of the Utica Gas & Electric Company in charge of commercial and public relations, has been affiliated with the Utica utility since 1904. He advanced rapidly in the company's ranks, and before the reorganization of the company in 1918 he had charge of the sales division of the electric department. Subsequently he was appointed commercial manager, creating in this capacity a new department having to do with the business policies of the company and general contact with the public. This department has expanded until it has become one of the most important factors in the organization. Mr. Reagan



W. J. REAGAN

G. H. STACK

is actively identified with many of the important organizations of the industry, including the National Electric Light Association and the Empire State Gas and Electric Association.

George H. Stack, who has been made vice-president of the Utica Gas & Electric Company in charge of finance, accounting, etc., as previously announced in the ELECTRICAL WORLD, had been serving as vice-president and secretary for the past year and a half. He was occupying the office of secretary-treasurer of the Utica utility in the spring of 1924 when M. Jesse Brayton died and Mr. Stack was selected to succeed him as vice-president and secretary. His new position as vice-president in charge of the important financial and accounting problems of the company is an enlargement of duties. Mr. Stack has also been elected vice-president and a director of the Central New York Power Company and the Newport (N. Y.) Electric Light & Power Company, both of which are controlled by the Utica company.

E. Chatterton, commercial engineer, has joined the northern division of the Alabama Power Company at Huntsville. Mr. Chatterton was formerly identified with the Electrical Testing Laboratories of New York.

Obituary

Reginald F. Halliwell, a member of the staff of the British Thomson-Houston Company, Ltd., and the company's principal designer of steam turbines, died October 10. Mr. Halliwell was born in 1871 and was educated at Brighton College. He joined the British Thomson-Houston Company in 1903.

Arthur H. Fleet, merchandising sales manager of the Cutler-Hammer Manufacturing Company, died recently at his home in Lynchburg, Va., after a long illness. Mr. Fleet, who was forty-five years of age, was connected with Southern railway systems before he entered the electric equipment field in Milwaukee in 1912.

Harrison Pierce Reed, general manager of the A. Kieckhefer Elevator Company, Milwaukee, since 1921, died September 27. A native of Milwaukee and a graduate of Cornell University, Mr. Reed affiliated himself with the Cutler-Hammer Manufacturing Company in 1909, remaining with that organization until he assumed the general managership of the Kieckhefer Elevator Company. Mr. Reed was a fellow of the American Institute of Electrical Engineers.

Allen A. Tirrill, fifty-two years old, an inventor and consulting engineer of the Westinghouse Electric & Manufacturing Company, died September 21. For many years he was associated with the General Electric Company, Schenectady, N. Y., and in 1910 became an engineer with the Westinghouse company. He left the company in 1916, but since that time had been one of its consulting engineers. He built the first dynamo and installed the first electric lights at Stewartstown, N. H., and constructed virtually all of the water-power plants in northern New Hampshire. In 1897 he put in the first voltage regulators in Lakeport and Concord, N. H. In 1914 he received the John Scott medal for his meritorious inventions, together with a diploma. He was a member of the American Institute of Electrical Engineers.

Commission Rulings

Justification of "Foreign" Holding Company.—In granting permission to the Power & Electric Securities Corporation, a Delaware-chartered holding company controlled by the same interests that own the Northern New York Utilities, to purchase control of the Malone Light & Power Company and buy outright two smaller companies (see ELECTRICAL WORLD for November 7, page 962), the New York Public Service Commission said: "The question naturally arises why the Northern New York Utilities, Inc., itself does not appear here as the petitioner rather than a foreign corporation. The evidence of petitioner is that in this era of rapid development and great demand for power a holding company furnishes the best practicable instrument of ready financing; that if whenever a new extension or development was proposed or the purchase of an existing property was necessary the common stockholders of the Northern New York Utilities had to pay in cash, it would be an impossible proposition. The Power & Electric Securities Corporation is a financial vehicle for developing the extension of all the properties and was created before any question arose as to permitting foreign corporations to hold the stock of domestic utilities. The Kellas interests of Malone filed a brief opposing the proposal, claiming that the obvious purpose is to get the stock of the three domestic utilities beyond the control of the commission. It is believed that those submitting this brief have not made a clear distinction between the jurisdiction which the commission exercises over the rates of utility corporations under its jurisdiction and the stock issues of holding companies. Rates to be charged within this state for utility service can only be put into effect by operating companies with the consent of the commission. Such rates are not, and in the very nature of things cannot be, made contingent upon the amount or kind of capital stock issues of the holding company, and the mere ownership of the stock of a domestic utility under the jurisdiction of this commission by a foreign holding company gives no advantage to the holding company or to any one else in the fixation of rates. The power to fix rates continues to rest wholly in the commission. And the courts hold that the basis for rates does not depend upon the capital issues of the operating company alone, but upon the value of the property used and useful in the rendition of public service."

Consumers of Electrical Energy Cannot by Law Be Made to Meet Railway Losses.—The non-remunerative railway system of the Helena (Mont.) Light & Railway Company has, the Montana Public Service Commission admits, been kept in operation by patrons of the electric and gas departments, to whom service has been rendered at rates which not only recompensed the costs of such services but, in addition, were planned to earn a fair return on the combined utility operations of this company. While denying to the company an increase of street-car fares on the ground that the plan proposed would, in the commission's opinion, prove fruitless, the commission said: "Of course, the consumers of electrical energy and gas may not, as a matter of law, be required to bear the burden of the failing railway; and notwithstanding their long acquiescence in the combination of the three departments, for the purpose of keeping a railway in operation within the city of Helena and between Helena and its environs, such customers ought to be relieved, as far as possible, of the necessity of making up the street railway's revenue deficiencies. We are ready to do anything that seems adapted to such purpose. . . . We are not to be understood as saying that it impossible to find a better fare structure than the one now existing. The initiation of rates lies with the management, not with the regulatory bodies."

Competition Between Power Company and Municipal Plant.—The city of Algoma, Wis., complained to the Wisconsin Railroad Commission that a new schedule of rates put in force by the Wisconsin Public Service Corporation discriminated against the city, which buys energy in bulk from the company, by granting reduced rates to power customers having connected loads in excess of 25 hp., the city as a consequence being unable to compete with the company for such business. The commission held that reduced electric rate schedules open to all consumers, including municipalities, were not discriminatory. A power utility, it added, is not guilty of unfair competition against a municipal plant in offering a reduced power rate to its larger power users when all the evidence seems to indicate that the larger power users should be, by understanding, rightfully the customers of the power company.

Utah Commission Recasts Its Valuation Methods.—In fixing rates for the Goshen Electric Company the Utah Public Utilities Commission announced its abandonment of historic cost as the sole or main factor in arriving at value, saying: "This commission, along with others, largely disregarded reproduction now at present prices and held broadly that the investment made and remaining in the property was the amount upon which the utility was entitled to earn a return. The wide spread in prices caused much confusion, and much was written in justification of this or that method to be used in arriving at a practical solution of the problem. More recently, however, a number of decisions have been rendered by the United States Supreme Court and other courts of competent jurisdiction, clarifying the situation, and the commission must recast its valuation methods in accordance therewith." The commission added that it is not bound to a slavish adherence to cost of reproduction less depreciation in determining the rate base, nor, on the other hand, it said, can cost of reproduction at prewar prices be countenanced.

Recent Court Decisions

Power of Colorado Supreme Court to Review Orders of Commission Is Discretionary.—In Clark vs. Denver & Interurban Railroad Company an attempt was embodied to have the Supreme Court of Colorado review a decision of the Public Utilities Commission of that state restraining competition. The court held that its power to review such decisions was discretionary, not obligatory, and declined jurisdiction on the ground that the issues could be fully determined and the rights of the parties preserved in the lower courts. It found, however, no rule requiring it to certify the case to such a court. (239 Pac. 20.)*

Canal Owning Water-Power Properties Is a Public Utility.—On a ruling that the Green Bay & Mississippi Canal Company, which leases water-power properties owned by it to other concerns, is a public utility, authority was denied to the Wisconsin Traction, Light, Heat & Power Company by the Wisconsin Supreme Court to institute condemnation proceedings against the canal company without first obtaining a certificate of convenience and necessity from the Railroad Commission. The court fight was the outgrowth of a dispute over the question of rent charged for the property of the canal company, which also leases its water-power properties to the city of Kaukauna for the municipal plant.

Admissibility of Expert Evidence on Hazards Involved in Defective Wiring.—Sustaining a verdict for the plaintiff, who (Crixwell vs. City of Brownsville) sued for damages because of the destruction of his house by fire due to alleged defects in the city lighting plant, the Court of Civil Appeals of Texas held that expert testimony that contact between electric wires near a house would set it on fire was admissible, as was also expert opinion, based on a statement to witness by the city electrician, that a transformer near plaintiff's house at time of fire was dangerous. Where defendant introduced evidence of the existence of a transformer near plaintiff's house to rebut possibility that a fire destroying the latter originated from electric wiring near the house, testimony that the transformer was defective and dangerous was relevant, and the court properly refused defendant's special issue submitting only question of negligence in constructing and maintaining a service wire dangerously near house. Acts of the city's foreman in discharge of his duty to see that there were no defective parts in the city's electrical equipment and his declaration as to what caused the fire which destroyed plantiff's house were admissible and binding on defendant city. (275 S. W. 430.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Opinion on Ball-Bearing Motors Divided

Manufacturers Hold Ball or Roller Bearings Essential for Special Uses—Many Now Offering a General Line of Such Motors to Meet a Demand

MOTOR manufacturers have generally recognized that ball or roller bearings have definite fields, and virtually all such manufacturers have used these types of bearings for certain special applications, even where the bulk of their product was equipped with bearings of the sleeve type. It is only in the last five years that the buyer who wanted a ball-bearing or roller-bearing motor has not been required to pay the price of a special motor. The smaller manufacturers were the first to furnish such motors as standard apparatus, and today many of these manufacturers carry a complete line—in some cases that type exclusively.

The demand for ball-bearing and roller-bearing motors, which really began to be felt about four years ago, is growing, according to manufacturers. This demand came first from the Pacific Coast for vertical pump motors and from the lumber industry. Even those manufacturers who had standardized on sleeve-bearing motors, including the larger manufacturers, have placed a line of ball-bearing motors on the market. One company recently announced a line of roller-bearing motors, and another company has been planning to announce a complete line of ball-bearing motors in all types and sizes. Late in 1924 and early in 1925 a large manufacturer was quoting both longer deliveries and much higher prices for motors equipped with ball bearings, but deliveries in many sizes of ball-bearing motors are now practically on the same basis that applies to the shipment of sleeve-bearing machines.

It is the practice to buy ball and roller bearings of various reputable companies, the motor manufacturer being solely dependent upon no one company. This has become possible owing to the standardization of balls and raceways, which are interchangeable for the same-sized bearing. A vast amount of advertising undertaken by the bearing manufacturers has been a considerable factor in leading motor manufacturers to take up this development and supply motors thus equipped to customers asking for them. From a commercial point of view the motor manufacturer has felt compelled to do this.

It has been estimated that the value of motors sold in the American market amounts to about $100,000,000 this year. The substitution of ball bearings on all new motors sold in one year will probably cost the purchaser about $10,000,000. Some motor manufacturers, indeed, have been led into this field because of competitive conditions. Cases have been more or less frequent where a motor user has thrown out sleeve-bearing motors and put in those of the ball-bearing type, and the tendency is naturally strong to give the user what he asks for in order to get back his trade so long as this can be done on sound engineering lines. There are some buyers who will not be satisfied with anything but a ball-bearing motor and vice versa, and manufacturers want the business of those who want a ball-bearing motor. Competition is now so keen that in some cases motor manufacturers are selling motors equipped with ball bearings for only 7 per cent more than the sleeve-bearing type, if not even lower than this.

It is believed that quality production and service will win in the long run, price being secondary in the mind of the intelligent buyer and user as compared with quality. The greatest value per dollar spent by the motor buyer is not primarily a matter of bearing types, one manufacturer believes, and it is very doubtful, he states, if any difference in the electric power bill can be found in operating motors of either type, other things being equal.

Adherents of the sleeve-bearing motor point to its simplicity as compared with the ball or roller bearing and refer to the fewer number of parts. They also state that more and a higher grade of work is required in ball-bearing or roller-bearing motors. However, for certain special applications and low-speed work where heavy weights are involved motor manufacturers believe

Value of Electrical Exports for September, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	September 1924	September 1925
Generators:		
Direct-current:		
Under 500 kw.	$58,739	$51,731
500 kw. and over	57,970	36,482
Alternating-current:		
Under 2,000 kva.	14,811	41,563
2,000 kva. and over	11,912	227,789
Steam-turbine generator sets	37,572	34,889
Accessories and parts for generators	38,526	54,359
Self-contained lighting outfits	64,168	90,480
Batteries:		
Flashlight batteries	48,779	78,471
Other primary batteries	59,470	93,528
Storage batteries	245,977	201,420
Transforming or converting apparatus:		
Power transformers	143,835	169,962
Other transformers	104,176	103,713
Rectifiers, double-current and motor generators, dynamotors, synchronous, and other converters	52,026	66,853
Transmission and distribution apparatus:		
Switchboard panels, except telephone	274,544	188,297
Switches and circuit breakers over 10 amp	118,444	274,680
Fuses and fuse blocks	22,038	30,984
Watt-hour and other measuring meters	87,894	64,864
Volt, watt and ampere meters and other recording, indicating and testing apparatus	95,791	120,917
Lightning arresters, choke coils, reactors and other protective devices	53,556	62,143
Motors, starters and controllers:		
Motors, under 1 hp.	129,349	190,510
Stationary motors:		
1 to 200 hp.	141,161	194,412
Over 200 hp	45,556	69,782
Railway motors	53,894	49,896
Electric locomotives:		
Railway	453,223	.....
Mining and industrial	15,411	56,783
Starting and controlling equipment for:		
Industrial motors	71,463	109,340
Electric railway and vehicle motors	1,647	5,468
Accessories and parts for motors	138,683	187,420
Electric fans	33,621	57,475
Electric lamps:		
Metal-filament	69,097	85,695
Other electric lamps	30,206	12,996
Flashlights	63,206	96,197
Searchlights and projectors	$53,136	$65,519
Motor-driven household devices	44,618	68,101
Domestic heating and cooking devices	83,047	92,662
Industrial electric furnaces and ovens	11,627	17,751
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	83,208	126,979
Signal and communication devices:		
Radio apparatus	567,434	785,337
Telegraph apparatus	60,833	23,880
Telephone apparatus:		
Magneto telephones	13,126	5,617
Other telephones	37,088	57,03?
Telephone switchboards	48,068	51,666
Other telephone equipment	188,903	141,804
Railway signals, switches and attachments	56,338	23,624
Bells, buzzers, annunciators and alarms	14,481	8,411
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	109,556	222,759
Insulating materials	113,791	137,459
Metal conduit, outlet and switch boxes	47,069	63,428
Sockets, receptacles and lighting switches	116,766	136,243
Electric lighting switches, interior and street	54,651	116,241
Other wiring supplies and line material	92,818	81,151
Other electrical apparatus	534,967	633,425
Globes and shades for lighting fixtures	32,335	39,307
Electrical glassware except for lighting	19,047	22,776
Electrical porcelain	134,276	†
Electrical porcelain for less than 6,600 volts	*	65,872
For 6,600 volts and over	*	86,460
Carbons, carbon brushes and electrodes	197,148	†
Electrodes for electric furnaces	*	90,715
Other carbon products	*	136,999
Insulated wire and cable (iron and steel)	17,991	13,162
Other manufactures of aluminum	82,170	46,984
Copper, bare wire	180,975	117,441
Copper, insulated wires and cables	276,?26	386,596
Total electrical machinery and apparatus and supplies	$6,108,538	$6,974,487

* Not separately stated prior to January 1, 1925.
† Discontinued beginning January 1, 1925.

that ball and roller bearings are well fitted. In starting up machinery the friction losses are lower with ball or roller bearings than with sleeve bearings, but motor manufacturers say that it remains to be seen how valuable the motor user will think this factor in comparing the prices of the two types. At the high speeds usually encountered in motor practice there is said to be virtually no difference in friction between the two types when up to speed.

BETTER SLEEVE BEARING NOW MADE

The agitation of the ball and roller bearing manufacturers has caused several improvements to be made in the sleeve-type bearing, and much is said to have been learned from the ball-bearing companies, especially as regards better sealing to prevent entrance of dust and foreign matter. Means have also been taken to improve the sleeve bearing as regards oil slinging. In general, while a large number of motor manufacturers are furnishing complete lines of ball-bearing or roller-bearing motors to meet the demand, those responsible from the greatest production tend to favor the sleeve-bearing type. From a production standpoint, however, those companies say that they would rather have a 100 per cent production of ball-bearing or roller-bearing motors, preferring that to half-way measures.

The opinion was expressed by a close observer that the present demand for ball-bearing motors may rise as high as one-third of the total production of alternating-current general-purpose motors during the next three or four years, after which the proportion may drop to perhaps one-fifth of the total.

Without attempting to enumerate the many advantages in the use of ball and roller bearings by their manufacturers, as many differences of opinion exist among motor manufacturers on some of the points, it cannot be disputed that the use of such bearings has steadily increased throughout the last ten years. This evidence of recognition of the possibilities for the use of ball and roller bearings in electric motors is said by the manufacturers of such bearings to have been brought about by the gain in confidence through increase in knowledge of the application and use of such bearings and improvements in bearing design and construction, as well as the standardization of ball bearings that makes them interchangeable regardless of make.

DIFFICULTIES DUE TO LACK OF KNOWLEDGE

Whatever difficulty has been experienced with ball bearings or their replacement, say the companies making them, has been owing to the lack of correct knowledge of the manipulation and the woeful lack of proper tools and equipment for the purpose, but it is believed that this condition is being remedied. Such companies are convinced that ultimately ball or roller bearings will become standardized on electric motors of the better class, and while they do not venture to predict when that time will be, they do not believe it is as far off as the motor manufacturers would have them believe.

The use of ball and roller bearings in automobiles is pointed to as a case where service conditions are at their worst, with the probable neglect of even ordinary mechanical care and attention. Fractional-horsepower motors are said to almost exactly parallel the automotive field. In motors of larger power conditions are somewhat different, but they still point to a need for the use of such bearings. Companies making ball and roller bearings say that the constant increase in the use of motors so equipped is the strongest argument for their use.

S. L. Nicholson Receives McGraw Award

Medal and Purse Presented at Banquet of Associated Manufacturers of Electrical Supplies—Honorable Mention Extended to C. A. Bates and T. E. Barnum

THE first presentation of the electrical manufacturers' medal and purse under the James H. McGraw award took place on Tuesday evening, November 10, at the Hotel Roosevelt, New York City, at the annual banquet of the Associated Manufacturers of Electrical Supplies. This award embracing four medals, one each to the manufacturing, jobbing and contractor-dealer branches of the electrical industry and a medal for co-operation, each accompanied by a purse of $100 in gold, was established this year "to encourage constructive thinking for the advancement of the electrical industry." The award is to be endowed in perpetuity and will be presented annually, sponsored by the following committee, representative of the industry: W. W. Freeman, president Union Gas & Electric Company, Cincinnati; H. B. Crouse, president Crouse-Hinds Company, Syracuse; W. E. Robertson, vice-president Robertson-Cataract Electric Company, Buffalo; L. K. Comstock, president L. K. Comstock & Company, New York; F. M. Feiker, vice-president Society for Electrical Development, and Earl E. Whitehorne, commercial editor ELECTRICAL WORLD.

The administration of the award has been placed in the hands of the Society for Electrical Development. The committee of judges for the manufacturers' award included Clarence L. Collens, 2d, president Electrical Manufacturers' Council; Gerard Swope, president Electrical Manufacturers' Club; W. H. Thornley, president Associated Manufacturers of Electrical Supplies; A. E. Waller, president Electric Power Club, and Earl E. Whitehorne, commercial editor ELECTRICAL WORLD.

The medal and purse were presented to S. L. Nicholson with the following citation:

Samuel L. Nicholson, assistant vice-president Westinghouse Electric & Manufacturing Company, New York, for many years has devoted much thought and time to promoting the idea of a standard electrical ordinance that, adopted by municipalities, would establish uniformity in inspection requirements in harmony with the National Electrical Code and the National Electrical Safety Code. Out of this would naturally come relief from the present uneconomic necessity for the production and distribution of duplicating types and sizes of many products required to meet the exactions of ill-conceived ordinances in force in different localities.

Mr. Nicholson, by the most conscientious and persistent personal effort and leadership, has inspired and carried through the perfection of such a model uniform ordinance and achieved its indorsement and acceptance by the organized industry, and its influence is being extended to a steadily growing number of communities.

In recognition of this very distinguished contribution to progress in the orderly regulation of the installation and inspection of electrical materials and equipment and its good effect for the advancement of the electrical manufacturing industry, the judges have awarded to Mr. Nicholson the manufacturers' medal and purse for 1925 given under the James H. McGraw award.

BRONZE MEDAL GIVEN UNDER THE JAMES H. MCGRAW AWARD ESTABLISHED THIS YEAR "TO ENCOURAGE CONSTRCUTIVE THINKING FOR THE ADVANCEMENT OF THE ELECTRICAL INDUSTRY"

Certificates of honorable mention were extended to C. A. Bates and T. E. Barnum with the following statements by the judges:

Clarence A. Bates, electrical engineer, Bryant Electric Company, Bridgeport, Conn., through his tireless and conscientious service as chairman of the standards committee of the Associated Manufacturers of Electrical Supplies has been responsible in a large measure for the great progress that has been made in the last two years in the development of standards in the manufacture of electrical supplies. He has brought to the work a degree of personal application and leadership that has conspicuously advanced the progress of standardization both in the acceptance of the idea and the actual production of practical standards that are today being generally accepted in the industry.

In recognition of this constructive con-

tribution to the advancement of the manufacturing branch of the electrical industry, the judges have awarded to Mr. Bates a certificate of honorable mention, given in conjunction with the manufacturers' medal for 1925 under the James H. McGraw award.

Thomas E. Barnum, chief engineer Cutler-Hammer Manufacturing Company, Milwaukee, as chairman of the casualty and fire-prevention committee of the Electrical Manufacturers' Council, has been an outstanding figure in the development, the defense and the promotion of the National Electrical Code and the National Electrical Safety Code, this being an important function of this committee. But Mr. Barnum, has given far more to this work than mere chairmanship of this active committee would entail. He has devoted to it an amount of time and effort and a degree of zealous purpose that has led to his assuming a heavy responsibility and a very large burden of labor in the analysis of legislation and the active direction of measures for casualty and fire prevention undertaken as a broad, unselfish service to electrical progress.

In recognition of this very constructive contribution to the advancement of the electrical manufacturing industry, the judges have extended to Mr. Barnum a certificate of honorable mention, given in conjunction with the manufacturers' medal for 1925 under the James H. McGraw award.

Business Conditions

THE electrical business shows an upward lift this week with good volume reported from practically all quarters. The trend of general business throughout the country has been toward increased activity and this is naturally reflected in the market for electrical materials and equipment, on top of which strong buying by the power industry has added substance and tone. General building operations are still on a large scale and detailed reports on a number of basic industries reported during the week show increases and spread optimism. Predictions on the earnings of prominent electrical manufacturers also indicate a generally good year in the electrical industry. The troubles of the corn farmer in the Middle West have not yet reacted on electrical sales in that section.

Reports from New England are encouraging, with a rising drift, particularly in industrial heating, transmission line equipment and household appliances. The general volume of sales for the New York district is strong with several large orders for power equipment and a healthy diversity in general demand. Southeastern states show marked increases in purchases by steam railroads and central stations and industrials are buying actively. Good business continues in the Middle West with marked industrial activity and a heavy demand for distributing equipment by utilities. On the Pacific Coast building construction is somewhat quieter, but power company buying continues good.

Non-Ferrous Metal Markets Quieter—Prices Lower

BUSINESS in the non-ferrous metal markets has quieted down. Copper has been unusually dormant in the domestic market and has declined in London, but prices have dropped but little. Lead has sold well, due to more adequate offerings. Zinc has reacted somewhat but continues strong.

At the 14¾-cent level on Wednesday and Thursday of last week copper showed little strength. On Friday most of the business was done at 14.80 cents for Connecticut deliveries and through the last few days producers have found it necessary to come to 14¾ cents to get any orders. The volume of sales for this week has been considerably less than last week. Foreign demand has been fairly good.

The contract price of the American Smelting & Refining Company for New York lead continues at 9¾ cents per pound, with offerings at that level freer than a week or two ago. In the Middle West this market has not yet declined to 9½ cents. Requests in general are for November-December shipment, with business widely distributed and all classes of consumers in the market. The zinc situation shows little change and the volume has not been large. Stocks of zinc have declined to unusually low proportions. The price has fallen off to $8.95.

NEW YORK METAL MARKET PRICES

	Nov. 4, 1925 Cents per Pound	Nov. 11, 1925 Cents per Pound
Copper, electrolytic	14⅞	14¾
Lead, Am. S. & R. price	9¾	9¾
Antimony	20	20
Nickel, ingot	34	34
Zinc, spot	9.20	.95
Tin, Straits	62⅜	62⅝
Aluminum, 99 per cent	29	29

Base copper price Nov. 11, 1925, 16½ cents

Steady Buying Marks New England Trend

THE tone in the purchase of electrical equipment and materials in general during the past week has been very encouraging, and with the exception of supplies for new building construction, and particularly for residences, the trade shows an upward swing, with industrial heating, transmission-line equipment, and household appliances the outstanding features.

High-voltage transmission-line supplies are in active demand, and orders have been received during the week for a number of shipments of poles, crossarms and hardware for stations in New Hampshire and Maine. In addition, one manufacturer reports an order from Louisiana for equipment for a 65-mile line. Household appliances are attracting increasing attention. Jobbers report a mounting volume of counter sales, with lamps strong and flatirons, socket units and cleaners quite active.

Installations of new electrical furnaces are reported by one manufacturer in Connecticut, Buffalo and the Middle West. This same firm reports business to date amounting to more than double that for the entire last year. Inquiries are being received from numerous quarters, including the Far East and European cities.

Interest in electric welding equipment parallels the encouraging tone reported in industrial heating. Short-arc equipment of both portable and rigid types is attracting much attention, and many inquiries are being received from shops and manufacturing plants. Electric lighting equipment is also more active. Manufacturers point to numerous high-power-type installations throughout this district as a sign of the turning from low-capacity units to 1,000-cp. and 1,500-cp. lamps. Small towns show an increasing interest in street lighting.

The demand for small motors is steady. Meters and regulators are moving with an even trend. Radio accessories continue to be the most prominent trade activity among many jobbers. The New England Telephone & Telegraph Company reports plans to expend $4,793,930 for new construction, which includes large allotments for underground work and central office equipment for various points throughout New England.

Business Generally Stronger in Southeastern States

FALL business is beginning to evidence itself in an upward swing in all lines. Steam railroads are active, and very satisfactory orders are being received for train dispatching and telephone equipment, poles and pole-line hardware used in this class of construction. Purchases by central-station companies of transmission and distribution materials, which slowed up several weeks back, are now good, and several very satisfactory orders for poles and pole-line materials were received this week. "White-way" equipment continues in active demand, with a large number of moderate orders in hand.

The industrial situation throughout the territory shows much improvement, and orders for motors ranging from 10 hp. to 200 hp. are on the increase. The electrification of ice plants is under way in earnest, and a brisk demand is reported for electrical equipment for changing over old plants and constructing new ones. Orders for motors of the synchronous type are evidencing the popularity of this type of drive. The recent drought is responsible to an extent for a large number of turbine inquiries, the number exceeding that for any month this year. No prediction can be made as yet as to whether all of these inquiries will develop into real sales.

Distribution transformers, meters and lamps are showing the usual fall activity, though the volume of sales is in excess of that anticipated. Socket appliances are moving well, there being an apparent tendency on the part of dealers to stock for the Christmas trade. Reflector-type heaters are moving satisfactorily, and flatirons are particularly active.

Florida as a whole continues the most active of the Southeastern States, despite the fact that the embargoes on freight shipments are slowing down business in that state somewhat. These embargoes are not only affecting building in Florida but are handicapping manufacturing and producing interests in other states which supply a large portion of Florida's demand.

Satisfactory Sales Continue in New York District

THE generally satisfactory conditions which prevailed in the New York district last week are continuing. Business in some lines is below that of October, but sales are being made in steady volume, and while there are few large orders, the totals attained are high. In general the largest demand is by the central stations.

One large manufacturer reports the receipt of an order for substation equipment amounting to $175,000 and for miscellaneous equipment amounting to $150,000. Other orders individually large and totaling $100,000 were also placed this week for power equipment, and there is considerable business of this class which it is expected will be closed up next week. One manufacturer of line equipment reports orders on the books now that will carry his plant for three months at full production. A motor manufacturer estimates that his bookings for this period are from 10 to 15 per cent higher than for the same period last year. Jobbers find business in all lines improving steadily, while radio sales are exceeding expectations and the radio market is expected to open wide within the next two weeks.

There is a large amount of building in process and in prospect, and the electrical contractors report a steady volume of work. Labor organizations in New York City are agitating for a 25 per cent increase in wages on January 1, but about twenty-five employers' organizations have declared flatly in opposition and it is not expected that the demand will be pressed. Meanwhile commitments for new construction may be slowed down.

Power-Company Buying Strong in Middle West

ALL sections of the Middle West are reporting good business conditions this week. Industrial activity is increasing and central-station construction work is progressing rapidly. There has been quite a large demand for distributing equipment by the various utility companies, among the interesting orders placed being one for ten 5,000-kva. transformers, one for a quantity of 2,000-amp. disconnecting switches valued at over $150,000, another for circuit breakers valued at $95,000 and several large sets of storage batteries for substation work. There has been an excellent demand for poles and pole-line hardware.

Jobbers say that their volume of business has improved materially, and October closed a satisfactory month in most cases. There was a good demand for all commodities and an excellent sale of appliances. The holiday season is coming into view, and most jobbers are placing their requirements of appliances. One manufacturer reports a single order from a jobber for $5,000 worth of irons. Radio sales are extremely good, particularly in sets.

Prices appear to have taken a somewhat stronger position here. The base price of copper advanced this week and lead advanced also. Manufacturers of "BX" announced a 5 per cent advance in price of this commodity, while wire manufacturers state that further advances in code wire prices will be necessary. The big drop in the price of corn has seriously affected farmers in Iowa, Illinois, Nebraska and Wisconsin and to a less extent in Kansas, South Dakota and Minnesota, but has not yet registered in the electrical market.

Building Quieter on Pacific Coast —Power-Company Buying Good

CURRENT business for building construction on the Pacific Coast has slowed down somewhat, and school, theater and apartment-house operations at present overshadow house and bungalow requirements. Railroad buying is lighter except for a few very large inquiries, comprising 200 miles of No. 9 "BB" iron wire, 150,000 No. 8 bond wires, 52 in. long, and 50,000 ft. of ⅝-in. strand. Power-company buying is good, especially for construction work in the San Joaquin and Salinas valleys, and includes inquiries and orders for such material as seven carloads of assorted 30-ft. 35-ft. and 40-ft. poles, 20,000 ft. ¼-in. guy strand, a thousand-dollar order for dead ends, 1,000 lb. weatherproof tape and 125 assorted pairs of pliers and grips. There are many pole-line hardware orders ranging from 5,000 to 10,000 pieces, and competition is especially keen on this line. Electrical machinery business has included an initial shipment of twelve cars of electric dredging equipment by the Yuba Manufacturing Company of California on a contract with the soviet government of Russia. These dredges are for platinum mining, and each is operated by motors aggregating 300 hp. to 400 hp. The total contract is said to have been for about $2,000,000, of which the electrical equipment is approximately 10 per cent.

More than three hundred residences built in Seattle this year have been equipped with electric heating systems. Manufacturers state that the demand for electric clothes driers, auto-heaters and water heaters is consistently improving and that 1925 will establish new records for sales of devices of this type. Owing to keen competition, prices show a 15 per cent decrease under last year. Materials used in manufacturing are easily obtainable in the Northwest, and prices show no marked change.

Activities of the Trade

Nizer-Kelvinator Merger to Take Place

It is authoritatively stated that the merger of the Kelvinator Corporation and the Nizer Corporation, prominent manufacturers of domestic electric refrigerators and commercial ice-cream cabinets respectively, both of Detroit, that has been current rumor for some time has been definitely agreed upon by the controlling interests of both companies. It is reported in the *Wall Street Journal* and confirmed from Detroit that, as a condition of the merger, the Nizer Corporation will declare a small stock dividend to equalize its shares with those of Kelvinator, when they will stand at 253,750, after the conversion of the A stock. There will be a relatively small amount of financing as a result of the merger.

Page & Hill Company Announces New Pole Service

The Page & Hill Company, Minneapolis, producer of Northern white and Western red cedar poles, butt-treated or untreated, announces that it is now in a position to furnish "P. & H." poles roofed, gained, shaved and bored for pole steps—ready to set. The company states that this work is performed according to the buyer's specifications in a careful, workmanlike manner with complete equipment and trained workmen.

Reports Many Electric Furnace Installations

A number of recent electric furnace installations reported by the American Metallurgical Corporation, Boston, are of striking interest as they indicate the wide range in use and the territorial expansion of this type of equipment. The Union Hardware Company, Torrington, Conn., has recently installed two additional furnaces, making now a battery of ten furnaces used for various hardening processes. A 30-kw. cyanide furnace was recently put into service in Hartford, and a 20-kw. pot furnace has been added to a Cleveland plant. The Pratt & Whitney Company has added four 20-kw. lead-pot hardening furnaces, making a total of nine in service. To this list a recent addition—one of 75 kw. capacity—for the Norton Company, Worcester, should be added.

Driver-Harris Absorbs Electrical Alloy Company

The Driver-Harris Company, Harrison, N. J., to provide additional capacity for its own production has purchased the works and properties of the Electrical Alloy Company at Morristown, N. J. This plant will be operated as the Electrical Alloy Division of the Driver-Harris Company, and its equipment will be utilized to produce special electrical and heat-resisting alloys of the Driver-Harris line. Increase in the wire business due to the demands both of the electrical heating and the radio industries has put a heavy load upon the company's Harrison works. With the addition of the Morristown plant it will be possible to maintain a larger research and development department and make possible increased production and an expanded service. The personnel of the Driver-Harris Company will remain the same.

The Empire Lighting Fixture Company of Los Angeles, with J. F. Mortensen at its head, has established a branch retail store and showroom at the corner of East Green and Chester Streets, Pasadena, Cal. This is the

fourth store to be opened by this company. At its factory, at 3160 Glendale Boulevard, Los Angeles, the company has over 16,000 sq.ft. of floor space. At present it is manufacturing more than 60 per cent of the fixtures which it sells in its retail stores.

The Delco-Light Company, Dayton, Ohio, announces that it has placed on the market a new model electric refrigerator with a ½-hp. compressor, known as the model 500 "Frigidaire."

The Pacific Electric Manufacturing Company, 827 Folsom Street, San Francisco, announces that H. D. Rives, for several years past associated with the New York office of the Delta-Star Electric Company, has resigned to become Eastern manager for the company and will be stationed at its office at 280 Madison Avenue, New York.

The Chase Brass Companies, Inc., Waterbury, Conn., announce that since November 1 they have opened their new warehouse at 134 Lafayette Street, New York, where they will carry a full stock of Chase brass, bronze and copper tubes, sheet and rod. It is also announced that a delivery service has been established for local orders.

The Sangamo Electric Company, Springfield, Ill., manufacturer of electric meters, announces the removal of its San Francisco office and warehouse to 1061 Howard Street.

The Chicago Fuse Mauufacturing Company, Laflin and Fifteenth Streets, Chicago, manufacturer of "Union" and "Gem" fuses and outlet and switch boxes, announces the removal of its Detroit office from the Transportation Building to 429 Wayne Street.

The Kelvinator Sales Corporation announces that B. L. How, formerly of the Western Electric Company, has been appointed district agent with headquarters at New Haven, Conn. Lance Underhill, for the past four years merchandising manager of the Connecticut Light & Power Company, Waterbury, has also been appointed district agent and will be associated with Mr. How.

The Cutler Hammer Manufacturing Company, Milwaukee, announces that it has adopted a new method of packing its attachment plugs, the caps and bases now being placed in separate boxes, to facilitate handling in the trade.

The F. W. Wakefield Brass Company, Vermilion, Ohio, is now offering to the trade a portable bracket under the trade name "Attachette," which, it is claimed, "attaches anywhere, any way."

The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a booklet entitled "Link-Belt 1875-1925," to commemorate its fiftieth anniversary. The book covers the history of the development of the conveying machinery business, which started with the invention of the Ewart detachable link belt fifty years ago.

The Milwaukee Electric Crane & Manufacturing Company, West Allis, Wis., has been reorganized under the name of the Milwaukee Electric Crane & Manufacturing Corporation. The new company, which acquired all of the assets and business of its predecessor, will take immediate steps to increase its business activities as well as expand its field of operation. The officers of the new corporation are: M. A. Beck, president; Henry S. Wright and A. J. Pitman, vice-presidents, and M. P. Obrien, secretary and treasurer.

A. E. Burland announces the opening of an office and warehouse at 170 Oliver Street, Boston, as a manufacturers' agent. Mr. Burland now represents the Beaver Machine & Tool Company, Newark, N. J.; the Betts & Betts Corporation, New York; the Saylor Electric & Manufacturing Company, Detroit; the Hatfield Rubber Works, Newark, N. J., and the Law Battery Company, Providence, R. I.

The American Metallurgical Corporation, engineer and manufacturer of electric furnaces, announces the removal of its offices to 27 Von Hillern Street, Boston, where a new factory will also be occupied.

The H. C. Roberts Electrical Supply Company, Inc., with establishments at Albany and Syracuse, N. Y., Philadelphia, Reading, Pa., Washington, and Baltimore, announces the opening of a branch house at 24 Wall Street Binghamton, N. Y., with H. J. Lavner as manager.

The Western Electric Company announces the appointment of A. H. Nicoll as sales manager at San Francisco. Mr. Nicoll first entered the employ of the Western Electric Company in 1909 as a sales record clerk.

The Trumbull Electric Manufacturing Company, Plainville, Conn., manufacturer of electrical supplies, announces that it is now offering a new line of "Circle T" panelboards for residence use, having from four to fourteen circuits—single-fused, three-wire or two-wire mains, two-wire branches; double-fused, two-wire mains, two-wire branches.

New Equipment Available

Power Drive

A new type of short-center, flexible drive, known as the "Texrope drive," has been announced by the Allis-Chalmers Manufacturing Company, Milwaukee. The "Texrope drive" consists of two grooved sheaves and a number of specially constructed endless "V" belts. The sheaves are set just far enough apart to allow the belts to fit the grooves without either tension or slack. Being elastic and stretchable, it is said that the belts do not jerk, either in starting, acceleration or running, nor do they transmit vibrations, but act as cushions between the driving and driven machines.

Bearing pressures are said to be low, since no belt tension is employed. The drive occupies very little space. It is silent, clean and is unaffected by moisture or dirt. Since there is no slip, the speed ratios are fixed and exact. The device is durable, and each belt carries its proportional share of the load. "Texrope drives" from ½ hp. to 250 hp., with ratios up to 7 to 1 and belt speeds from 800 ft. to 6,000 ft., have already been placed in service and have been applied to nearly every industry.

Universal Coupling

The "Sykes" universal shaft coupling, which differs from the usual flexible coupling in that it is actually a universal joint, has been placed on the market by the Farrel Foundry & Machine Company, Buffalo. This coupling is thus not only capable of taking care of small errors in misalignment but will also connect shafts which are badly misaligned. Its limit of angularity is said to be 5 deg., and it will also connect shafts which are offset as much as 4 per cent of the shaft size.

The coupling is of the three-element type, two of the elements in the form of hubs being keyed to the shafts and the third element, which is made in halves and forms a sleeve, connecting the other two elements. The actual connection, however, is by means of ball bearings in races or grooves formed in lugs. The coupling is at present available for shafts ranging from ¾ in. to 8 in. in diameter, the 8-in. coupling transmitting 1,200 hp. per 100 r.p.m.

Automatic Change-Over Switch

An automatic change-over switch of the oil type, that has for its chief application installations where continuity of service is the primary feature and where interconnected secondaries are not available, has been designed and is being manufactured by the Westinghouse Electric & Manufacturing Company. The switch is full automatic and functions to keep the main contacts on a predetermined circuit so long as that circuit is energized. By opening a single-throw knife switch the main contacts can be thrown from the preferred to the auxiliary circuit, and by closing the knife switch the main contacts will be returned to the preferred circuit. This switch depends for its operation on the action of an undervoltage release coil.

When the voltage fails in the preferred circuit the main contacts of the switch are transferred to the auxiliary circuit and remain on that circuit until the service voltage is restored to the preferred circuit. When energy is restored to the preferred circuit the main contacts of the switch are returned to that circuit. The action of the switch is nearly instantaneous.

Fuel Waste Meter.—For measuring heat waste in a boiler plant, the Uehling Instrument Company, Paterson, N. J., has recently developed a recording instrument known as the waste meter. With this meter the fuel wasted may be determined either in dollars and cents, or in B.t.u., or in per cent of the fuel burned during any time interval. The meter records the temperature of the escaping flue gases and their percentage of carbon dioxide on the same chart.

New Trade Literature

STOKERS.—The American Engineering Company, Philadelphia, has issued a booklet describing the "Taylor" stoker. It contains numerous illustrations showing various applications of the stoker. A description of the "Taylor" distributing ram system of fuel distribution under positive mechanical control is included, as well as a short outline of the "Taylor" steam-operated ash discharge. The company is also distributing a leaflet containing a condensed summary of tests made at the Hell Gate station of the United Electric Light & Power Company, New York City.

FLOOR OUTLETS.—A folder issued by Walker Brothers, Philadelphia, describes and illustrates the Walker "All-Steel" underfloor duct system for connections to light, telephone and bell circuits.

DUST MASK.—The Engineering Products Corporation, Inc., 64 Wall Street, New York, is distributing a folder calling attention to the "Epco" dust mask designed for workers in a dust-laden atmosphere. It is made in two types, known as type A and type B, one for cleaning boilers or other heavy-dust operations and the other for paint spraying, sand blasting and other light cleaning operations.

INDICATING THERMOMETERS.—The Foxboro Company, Inc., Foxboro, Mass., has issued bulletin No. 148 covering its indicating thermometers, including dial-type, stem-type, turbine-bearing, duplex-indicating, electric contact attachment types, etc. A number of illustrations are given showing various applications of the thermometers.

BUSBAR SUPPORTS.—Bulletin No. 31-B issued by the Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago, describes its high-tension indoor universal "Unit Type" busbar supports. Illustrations are given showing several installations of the "Unit Type" supports, and detailed dimensions of supports up to 120 kv. are included.

CARBON CIRCUIT BREAKERS.—Circular 1705-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., contains a description of its type "CL" carbon circuit breakers designed especially for 250-volt industrial applications where a compact breaker is required.

TRUCK AND TRAILER CRANES.—Bulletin No. 635-X, issued by the Harnischfeger Corporation, Milwaukee, describes and illustrates the "P. & H." truck and trailer cranes.

PNEUMATIC AND HYDRAULIC PUMPING MACHINERY.—The Pennsylvania Pump & Compressor Company, Easton, Pa., has issued a new general products catalog, No. 125, covering its complete line of pumping machinery. It contains illustrations showing various installations of Pennsylvania air compressors and centrifugal pumps, portable air compressors, etc.

ELECTRIC POWER REGULATOR.—The Pittsburgh Electric Furnace Corporation, Thirty-second and Putney Streets, Pittsburgh, is distributing a pamphlet describing the senior model "Edmoore Power Demand Limitator," which is designed for automatically controlling and limiting the power demand or peak load on large power loads. The bulletin lists the advantages to be secured in the use of the "Limitator."

FIRE DETECTOR AND EXTINGUISHER.—Walter Kidde & Company, Inc., 140 Cedar Street, New York City, is distributing a circular describing and illustrating the "Rich" system for detecting overheating in machines before the fire occurs and the "Lux" system for extinguishing fires in generators, condensers, converters, transformers, oil-switch rooms, etc.

MECHANICALLY OPERATED FLOW METERS.—Bulletin No. GEA-10, published by the General Electric Company, Schenectady, N. Y., describes the "G. E." mechanically operated flow meters for measuring fluid and gases. It contains a list of specifications to which the "G. E." mechanically operated flow meter is adapted and explains the operation on steady flow and reciprocating units. Included in the bulletin are illustrations of the various types of recording charts.

CONDUIT FITTINGS.—"A Message for You of Economic Importance" is the title of a booklet issued by the Erie Malleable Iron Company, Erie, Pa., which contains the story of the "Emico Kondu-Box" fittings. Facts concerning costs of construction are given, and curves showing the relative labor expended in installing various terminal conduit fittings are included. The various types of "Kondu" fittings for standard applications are illustrated.

ROLLER-BEARING MOTORS.—Bulletin No. 1,132 issued by the Allis-Chalmers Company, Milwaukee, describes its types "AR" and "ARY" polyphase induction motors with cast-steel frames and "Timken" tapered roller bearings.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

HOLYOKE, MASS.—The Holyoke Water Power Company has secured permission for the construction of a steel-tower transmission line across the Connecticut River above the state dam.

LAWRENCE, MASS.—An agreement has been entered into between the City Council and the Eastern Massachusetts Street Railway Company providing for the installation of an ornamental lighting system on Essex Street. The plans provide for the use of two-lamp standards.

DEVON, CONN.—The Connecticut Light & Power Company, Waterbury, has authorized the immediate construction of an addition to its local steam-operated power plant with the installation of additional equipment rated at 28,000 kw. Tentative plans are under advisement for a hydro-electric power development on the Housatonic River.

MERIDEN, CONN.—The Connecticut Light & Power Company, Waterbury, has taken out a permit to construct a one-story substation on Chase Street, to cost about $18,000.

MERIDEN, CONN.—The Connecticut Light & Power Company, Waterbury, which has acquired the property of the Meriden Electric Light Company, is planning to extend its high-tension lines from Devon to Meriden, a distance of about 35 miles. Rights-of-way have been acquired.

NEW LONDON, CONN.—The Eastern Connecticut Power Company, Norwich, Conn., is concluding negotiations for the purchase of the local substation of the Connecticut Power Company on Williams Street, and will remodel and improve it. Additional equipment will be installed.

Middle Atlantic States

BUFFALO, N. Y.—The Buffalo General Electric Company has filed plans for the construction of a one-story substation at 955 Bailey Avenue, to be used for switching service, estimated to cost $50,000.

CATSKILL, N. Y.—The Acme Cement Corporation, 8 West Fourtieth Street, New York, N. Y., plans the installation of electric power equipment in its proposed mill addition, to cost $150,000. McClellan & Junkersfeld, 68 Trinity Place are engineers.

CUYLERVILLE, N. Y.—The Village Board is considering the installation of a street-lighting system throughout the village.

EASTHAMPTON, N. Y.—The Long Island Lighting Company, 50 Church Street, New York, is reported to be planning extensions in transmission and distributing systems of the Easthampton Electric Light Company, recently acquired.

GLOVERSVILLE, N. Y.—The Fulton County Gas & Electric Company has been granted permission to distribute electricity in the villages of Esperance and Delanson and in a portion of Duanesburg. The company plans to extend its transmission line from the substation at Central Bridge.

MAYVILLE, N. Y.—The Board of Supervisors of Chautauqua County has contracted with the Niagara, Lockport & Ontario Power Company, Buffalo, for the installation of electric lamps along the highway on both sides of Chautauqua Lake. The cost is estimated at about $30,000.

STISSING, N. Y.—The Central Hudson Gas & Electric Company, Poughkeepsie, has acquired the Stissing Light & Power Company and will consolidate it with its system. Plans are under consideration for extensions in transmission lines in this section.

HILLSBORO, N. J.—The New Jersey Power & Light Company, Dover, has acquired the property of the Raritan Valley Hydro-Electric Company and will consolidate with its system. Plans are under consideration for extensions in transmission lines.

HOBOKEN, N. J.—The Public Service Electric & Gas Company, Newark, plans to remodel its local power house and will convert into a substation. Present equipment will be removed and machinery installed for an initial capacity of 14,000 kva.

MIFFLINBURG, PA.—Halfpenny & Grove, operating a local power plant, have made application for permission to install and operate a power station and system in Lewis Township, Union County, for commercial service.

MOUNT PLEASANT, PA.—The installation of an ornamental lighting system in the business district is under consideration by the City Council.

NEW CASTLE, PA.—Plans for improvements to the works of the New Castle Paper Mills Company include a new power plant.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired property at G and Luzerne Streets, totaling 17½ acres, and will use a portion of the site for a proposed substation, for which plans will soon be drawn.

RIDGWAY, PA.—Plans for the proposed extension of the Holmes Silk Mills include a power plant.

SHARON, PA.—The City Council is considering the installation of street lamps in the East End, on Independence Court, Wengler, Leslie and Myrtle Avenues, Budd and Tenth Streets and Highland Road.

WARREN, PA.—The Warren Veneer & Panel Company is planning to build a new power station at its local plant, including the installation of additional generators, etc.

WILMINGTON, DEL.—The Jessup & Moore Paper Company, Commercial Trust Building, Philadelphia, Pa., plans the installation of electric power equipment in connection with extensions and improvements in its local Augustine mills, estimated to cost $550,000.

BALTIMORE, MD.—The installation of electric lamps on St. Paul Street from Twentieth to Thirty-first Street is under consideration by the City Council.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company will proceed at once with the initial unit of its proposed steam-operated electric generating plant on the waterfront, to cost approximately $3,000,000. Three additional units will be constructed later on, making a total cost of about $10,000,000.

GATE CITY, VA.—The Gate City Light & Power Company and the Estillville Water Company have been consolidated and will be operated under the name of the Branson Service Corporation. Extensions are contemplated to the system. J. F. Branson will be president.

ALDERSON, W. VA.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until Nov. 30 for conduit wiring, electrical equipment, electric lighting fixtures, telephone conduit system, distribution cabinets and panels, fire-alarm system, storage-battery system, battery-charging equipment, etc., for the local Federal Industrial Institution for Women.

North Central States

IONIA, MICH.—The Consumers Power Company, Jackson, will make extensions and betterments in its local power plant recently acquired, including the installation of additional equipment.

AKRON, OHIO.—Steps have been taken to secure the installation of street lamps on Bloomfield Avenue from Exchange Street to Burton Avenue, Alhambra Way and Gordon Drive.

BUCYRUS, OHIO.—The Hadfield-Penfield Steel Company plans the installation of electric power equipment in the proposed addition to its plant, reported to cost in excess of $200,000, with equipment.

LOUISVILLE, KY.—A permit has been granted to the Southern Baptist Hospital, Lexington Road and Grinstead Drive, to build a power house, to cost $45,955.

LOUISVILLE, KY.—The Kentucky Hydro-Electric Company contemplates the

construction of a group of hydro-electric power plants at government dams on the Kentucky River. The initial work will cost in excess of $6,000,000.

PADUCAH, KY.—The Kentucky Utilities Company, Louisville, which has acquired the property of the Paducah Electric Company, plans extensions in the power plant and the erection of a high-tension transmission line from Paducah to connect with other plants and lines of the company in Kentucky. The local plant will also be connected with the lines of the Central Illinois Public Service Company, Springfield, Ill., and the Grand Tower generating station on the Mississippi River.

BEDFORD, IND.—The William McMillan & Son Company plans the installation of electric power equipment in a proposed local limestone mill, 135 ft. x 600 ft., to cost close to $250,000, with machinery.

KOKOMO, IND.—The Kokomo Steel & Wire Company, a division of the Continental Steel & Wire Company, recently organized, plans the installation of electric power equipment in connection with extensions and improvements in its plant, to cost in excess of $400,000.

CHICAGO, ILL.—Bids will be received by the Signal Corps, Procurement District, until Nov. 17, for 322 cable terminals (Circular 4); also, at the same time, for 140 telephone switchboard relays (Circular 5), and until Nov. 18 for 960 automatic telephone dials (Circular 6).

CHICAGO, ILL.—The Commonwealth Edison Company has filed plans for the construction of an addition, 50 ft. x 100 ft., to its substation at 2200-62 Fisk Street, to cost about $175,000; it will be equipped as a frequency-changer unit. Plans have been completed, also, for a one-story addition to the substation at 3501 South Crawford Avenue, to cost $155,000.

FRANKLIN PARK, ILL.—The Central Lumber Terminal Company, affiliated with the Acme Lumber & Shingle Company, 20 West Jackson Boulevard, Chicago, plans the installation of electric power equipment in its proposed lumber mill in the Mannheim district, to cost about $150,000.

BURLINGTON, WIS.—The City Council has decided to install electrically driven pumps in the pumping station to replace the present steam-operated equipment.

MADISON, WIS.—Surveys have been completed by the Wisconsin Power & Light Company for its proposed 33,000-volt transmission line from its hydro-electric plant at Kilbourn, a distance of about 16 miles.

OCONTO, WIS.—Plans are under consideration by the Wisconsin Public Service Corporation for extending its transmission lines from Oconto along Highway 15 to serve electricity to the towns of Pensaukee, Brookside and Abrams. When this is completed the line may be extended to Little Suamico.

PEMBINE, WIS.—Arrangements have been made whereby the Wisconsin Public Service Corporation, Green Bay, will install a new street-lighting system here.

COLUMBIA HEIGHTS, MINN.—Plans are being considered by William Leitch, city manager, for the installation of street lamps on Reservoir Boulevard leading to the Columbia Heights filtration plant.

DULUTH, MINN.—The Minnesota Power & Light Company plans the rebuilding of the portion of its substation on Commerce Street, recently destroyed by fire with loss estimated at about $75,000, including equipment.

MINNEAPOLIS, MINN.—The City Council has approved the apportionment of 122 street lamps to be installed during 1926.

ROCHESTER, MINN.—The City Council is arranging a fund of $11,000 for the installation of a municipal fire-alarm and police signal system. A. F. Wright is city clerk.

CUMMINGS, N. D.—The Northern States Power Company, Minneapolis, Minn., plans for the construction of a transmission line from Hatton, N. D., for local commercial service. Permission has been granted.

MICHIGAN, N. D.—Permission has been granted the Otter Tail Power Company, Fergus, Minn., to erect a transmission line betwen Michigan and Petersburg.

PETERSBURG, N. D.—The Otter Tail Power Company has secured permission for the construction of a transmission line from Michigan, N. D., for local commercial service.

SIOUX FALLS, S. D.—The City Council is considering a bond issue of $300,000 for extensions and improvements in the municipal electric light and power plant and system.

DES MOINES, IOWA.—The City Council has passed a resolution for the installation of an ornamental lighting system on Eighth Street, South, from Grand Street to Keosauqua Way. Karl C. Kastberg is city engineer.

ST. LOUIS, MO.—Bids will soon be asked by the Board of Public Service, City Hall, for construction of a power service station, repair shops, etc., on Clarke Avenue, to cost about $1,000,000. Study & Farrar, Arcade Building, are architects.

Southern States

BEULAVILLE, N. C.—The Board of Commissioners has tentative plans under advisement for the installation of an improved lighting system in the down section.

BELMONT, N. C.—The Chronicle Mills, Inc., plan the installation of electric power equipment in a proposed addition, estimated to cost $200,000.

WINSTON-SALEM, N. C.—The R. J. Reynolds Tobacco Company plans the installation of electric power equipment in connection with its proposed additions at Fourth and Fifth Streets and Patterson Avenue, to cost about $1,000,000.

SPARTA, GA.—The Georgia Southern Power Company, Dublin, Ga., is concluding negotiations for the purchase of the local municipal power plant and plans extensions in transmission lines in this section.

AVON PARK, FLA.—Arrangements have been made by the City Council with the Florida Public Service Company, Orlando, whereby the company will take over the ornamental lighting system of the city along the Mall and extend it more than a mile.

PALMETTO, FLA.—A proposition is under consideration for the installation of a municipal electric light plant. A portion of a proposed bond issue of $300,000 will be used for the work. The Chamber of Commerce is at the head of the project.

PERRY, FLA.—The installation of an ornamental lighting system is under consideration by the City Council.

PUNTA GORDA, FLA.—At an election to be held soon the proposal to issue bonds for an extension to the municipal electric lighting system will be submitted to the voters.

SALERNO, FLA.—Bonds to the amount of $22,000 have been voted for the installation of an ornamental lighting system.

STUART, FLA.—Bonds to the amount of $25,000 have been voted for extensions to the street-lighting system.

TAMPA, FLA.—Plans are under way by the Henderson Boulevard Association for the installation of an ornamental lighting system the entire length of this highway.

MEMPHIS, TENN.—The Fisher Body Corporation, Detroit, Mich., plans the installation of electric power equipment in the proposed addition to its local automobile body plant, to cost about $2,000,000.

ALTOONA, ALA.—A franchise has been granted to the Alabama Power Company, Birmingham, to supply electricity in Altoona.

COLUMBIA, MISS.—The Mississippi River Power Company, Gulfport, contemplates improvements to its local plant, including the installation of additional machinery.

JACKSON, MISS.—The Martin-Parry Corporation, York, Pa., contemplates the installation of electric power equipment in a projected plant in this section, to cost close to $200,000, with machinery.

NEW ORLEANS, LA.—The Todd Engineering, Drydock & Ship Repair Company plans the installation of electric power equipment at its proposed drydock and ship repair works near the Algiers Naval Station, to cost in excess of $250,000.

WHITE CASTLE, LA.—At an election to be held Dec. 1 the proposal to issue $28,000 in bonds for extensions to the municipal electric plant will be submitted.

BLACKWELL, OKLA.—The proposal to install a 1,250-kw. steam turbine, to cost about $40,000, has been approved by the voters.

EL PASO, TEX.—The El Paso Electric Company plans to extend its electric transmission line from Fabens to serve the towns of Tornillo, Acala, Fort Hancock and McNary and a large drainage district which requires fifty pumping plants. The proposed extension will be about 35 miles and will cost about $200,000.

SAN MARCOS, TEX.—Steps have been taken by the Chamber of Commerce for the installation of an improved street-lighting system.

Pacific and Mountain States

CHELAN, WASH.—The Chelan Electric Company has secured permission to proceed with its proposed hydro-electric power development on the Chelan River, to develop a capacity of 100,000 hp., estimated to cost $8,500,000, with transmission system. The station will be operated by the Washington Water Power Company, Spokane, and used primarily for service for the Great Northern Railroad in connection with the electrification of its lines in this district.

PROSSER, WASH.—Work will begin at once by the Pacific Power & Light Company, Portland, Ore., on an extension of its service lines from Prosser to the Irrigation experiment station, 1½ miles distant, to furnish electricity for lamps and motors.

YAKIMA, WASH.—The Swak Mining Company, Yakima, plans the construction of a hydro-electric power plant on Ingalls Creek for service at its mines in the Blewitt Pass section. Application for permission has been made.

HERMOSA, CAL.—The Board of City Trustees has approved the installation of an ornamental lighting system on Hermosa Avenue and a number of other streets, using concrete standards.

LONG BEACH, CAL.—The Southern California Edison Company, Los Angeles, has authorized immediate work on its proposed local steam-operated generating plant and switching station, estimated to cost $800,000. Stone & Webster, Inc., Byrne Building, Los Angeles, is engineer and will be in charge of construction.

LOS ANGELES, CAL.—The Water and Power Commission, 207 South Broadway, has rejected bids recently received for turbine generating equipment, conduits and accessory apparatus for a proposed municipal power plant. It is expected to ask new bids in the near future.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors, Hall of Records, until Nov. 23 for the installation of additional standards in the Miramonte-Florence lighting district and Graham lighting district, involving a total of 110 units in all. Specifications at the office of the mechanical department, tenth floor, Hall of Records.

LOS ANGELES, CAL.—The Baash-Ross Tool Company, manufacturer of oil-well tools, will install electric power equipment in its proposed plant on South Boyle Avenue, estimated to cost $100,000. The Moran Company, Kerckhoff Building, is architect.

OAKLAND, CAL.—The Great Western Power Company has plans for an addition to its station at Park Boulevard and Mathews Avenue, estimated to cost $38,700.

SACRAMENTO, CAL.—The City Council is considering a bond issue for the installation of an electric fire-alarm system in the downtown section. Plans will be drawn in the near future.

SAN CARLOS, CAL.—The City Council has plans under way for the installation of an improved lighting system on a number of streets. Lyle Clark is city electrician, in charge.

SAN FRANCISCO, CAL.—Steps have been taken by the Clement Street Merchants' Association for the installation of an improved lighting system on Clement Street from Fourth Avenue to the Beach District.

SAN FRANCISCO, CAL.—Bids will be received by the Signal Corps, Presidio, until Nov. 26, for 3,000 Signal Corps batteries.

PLACERVILLE, IDAHO.—The Mineral Mining Company, Inc., plans to build a power plant at its local mining properties.

DODSON, MONT.—The City Council has disposed of a bond issue to be used for the installation of an electric light and power system.

HARLEM, MONT.—The Montana Power Company, Butte, has approved plans and authorized construction of its proposed transmission line from Chinook.

Electrical Patents

Announced by U. S. Patent Office

(Issued October 13, 1925)

1,557,465. ELECTROMAGNETIC BRAKE; G. K. Mitchell, Baltimore, Md. App. filed April 9, 1920. For use with electric elevators.

1,557,474. CONTINUOUS ROTARY ELECTROPLATING MACHINE; H. B. Farrand, Philadelphia, Pa. App. filed June 27, 1923.

1,557,508. ELECTRICALLY HEATED FUNNEL; E. Weiss and F. Hnilo, Chicago, Ill. App. filed July 20, 1923.

1,557,537. AUTOMATIC CAR AND ELECTRIC COUPLER; G. C. Geiger, East McKeesport, Pa. App. filed April 9, 1921. Coupling for toy trains.

(Issued October 20, 1925)

1,557,544. CARRIER-FREQUENCY ARRANGEMENT; H. A. Affel, Brooklyn, N. Y. App. filed April 18, 1924. For multiplex signaling.

1,557,562. FREQUENCY SELECTIVE DEVICE; G. Crisson, Hoboken, N. J. App. filed Oct. 16, 1919. For signaling system.

1,557,573. BUTT-WELDING MACHINE; P. Fassler, Detroit, Mich. App. filed April 18, 1924.

1,557,596. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; W. E. Lamb, Oakland, Cal., and R. W. Mason, Berkeley, Cal. App. filed July 8, 1921.

1,557,609. PRINTING-TELEGRAPH EXCHANGE SYSTEM; D. B. Perry, Yonkers, N. Y. App. filed Nov. 10, 1923.

1,557,633. TRANSLATING DEVICE; G. S. Vernam, Brooklyn, N. Y. App. filed April 21, 1920. For automatically translating a code suitable for a land line into a code adaptable for a submarine cable.

1,557,642. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed June 20, 1921. Automatic ringing system.

1,557,666. TERMINAL CONNECTER; C. M. Davis, Lynn, Mass. App. filed Oct. 27, 1919. For storage-battery terminals.

1,557,678. ACOUSTIC CINEMATOGRAPHIC APPARATUS; J. Engl and J. Massolle, Berlin-Grunewald, Germany, and H. Vogt, Berlin-Wilmersdorf, Germany. App. filed April 4, 1921.

1,557,682. ELECTRIC HEATER; M. S. Gazelle Highland Park, Mich. App. filed April 10, 1925. Instantaneous heater.

1,557,692. TYPE-WHEEL-SETTING MECHANISM FOR PRINTING TELEGRAPH RECEIVERS; G. S. Hiltz, Brooklyn, N. Y. App. filed Feb. 8, 1923.

1,557,860. ELECTRIC CIRCUITS; R. C. Mathes, Wyoming, N. J. App. filed Jan. 15, 1920. For reducing the distortion in a repeating system.

1,557,913. COMBINATION TROLLEY WHEEL AND SHOE; A. L. Woodring, Waterloo, Iowa. App. filed Jan. 3, 1922.

1,557,914. ELECTROMAGNETIC SOUND-WAVE INTENSIFYING DEVICE; A. Wyatt, Kansas City, Mo. App. filed April 10, 1922.

1,557,931. ELECTROLYTIC ELECTRICITY METER; M. Grossmann, Jena, Germany. App. filed July 20, 1923.

1,557,979. APPARATUS FOR MEASURING AND DETECTING X-RAYS; T. W. Case, Scipio, N. Y. App. filed March 31, 1921.

1,557,991, 1,557,992, 1,557,993. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed March 24, 1906.

1,558,000. METHOD OF MAKING TUNGSTEN WIRES; H. M. Fernberger, Asbury Park, N. J. App. filed Feb. 10, 1922.

1,558,010. FUSE PLUG; A. Goemann, Baltimore, Md. App. filed Dec. 22, 1924. Multi-element type.

1,558,032. ARRANGEMENT FOR ACOUSTIC CINEMATOGRAPHY; J. Massolle, Grunewald, Germany; H. Vogt, Berlin-Schoneberg, Germany and J. Engl, Grunewald, Germany. App. filed April 4, 1921.

1,558,043. ELECTRICAL CONDENSER; W. H. Priess, Belmont, Mass. App. filed April 28, 1921. For high-potential work.

1,558,052. CONTROLLER FOR ELECTRIC MOTOR VEHICLES; J. Schurch, Los Angeles, Cal. App. filed Sept. 15, 1922.

1,558,053. TWO-WAY REPEATER AND AMPLIFIER; W. G. Sexauer, San Antonio, Tex. App. filed Jan. 25, 1923.

1,558,076. INDICATING DEVICE FOR STORAGE BATTERIES; R. N. Chamberlain, Chicago, Ill. App. filed April 18, 1924.

1,558,077. ELECTRIC IRON; A. R. Cheeseman, Toronto, Ontario, Canada. App. filed Jan. 5, 1924.

1,558,095. DYNAMO-ELECTRIC MACHINE; F. Kratz and M. Schafer, Stuttgart, Germany. App. filed Aug. 11, 1921. Magneto-electric ignition device.

1,558,111. VACUUM TUBE; H. E. Metcalf, San Leandro, Cal. App. filed March 23, 1925. Three-electrode type.

1,558,116. ELECTRIC SWITCH; C. D. Platt, Bridgeport, Conn. App. filed May 13, 1922. Safety type.

1,558,120. RADIO-RECEIVING SYSTEM; F. G. Simpson, Seattle, Wash. App. filed April 3, 1922.

1,558,144. ELECTRIC RELAY; H. Chireix, Paris, France. App. filed Aug. 29, 1921. Ultra-sensitive system using a three-electrode tube.

1,558,193. SAFETY DOOR; C. H. Luckling, Detroit, Mich. App. filed Aug. 24, 1923. For vaults in banks, etc.

1,558,211. LINE-TESTING APPARATUS; C. D. Williams, Silver Lake, Kan. App. filed May 4, 1922. For testing metallic circuits or grounded circuits.

1,558,231. MULIPLEX TELEGRAPHY; W. M. Bruce, Jr., Springfield, Ohio. App. filed May 2, 1921.

1,558,242. SWITCH MECHANISM FOR ROAD SIGNALS; G. H. Dalman, Ripon, Cal. App. filed June 15, 1922.

1,558,277. ELECTRICAL SWITCH; L. A. Phelan and C. Hotchkiss, Beloit, Wis. App. filed Dec. 8, 1922. Having movable electrodes in a hermetically sealed glass container.

1,558,280. SECRET SYSTEM OF TELEGRAPHY; L. M. Potts, Baltimore, Md. App. filed March 22, 1920.

1,558,312. ELECTRIC FLATIRON; P. Szent, Chicago, Ill. App. filed March 8, 1922.

1,558,331. THERMALLY ACTUATED ELECTRIC SWITCH; P. W. Baker, Putney, London, England. App. filed Sept. 1, 1921. For the control of flashlight devices.

1,558,351. ELECTRIC WRITER; R. Guasco, Aguascalientes, Mex. App. filed Sept. 23, 1924.

1,558,353. ELECTRIC RESISTANCE WELDING; C. A. Hadley, Inverness, Scotland. App. filed July 8, 1924.

1,558,373. FIXTURE FOR REBASING LAMPS; R. C. Leake, Rochester, N. Y. App. filed Sept. 24, 1921.

1,558,386. MOUNTING FOR INCANDESCENT LAMPS OR RAILWAY LIGHT SIGNALS; E. W. Moore, Rochester, N. Y. App. filed Sept. 30, 1921.

1,558,415. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed May 19, 1922. Escapement mechanism for rotary snap switch.

1,558,422. ELECTRIC ARC LAMP; M. J. Wohl, New York, N. Y. App. filed Oct. 7, 1920. In which a plurality of arcs are simultaneously employed for photographic illumination.

1,558,423. REGULATION FOR ARC LAMPS; M. J. Wohl, Long Island City, and M. Mayer, New York, N. Y. App. filed July 25, 1921.

1,558,431. STORAGE-BATTERY CLIP; H. E. Walker, Chicago, Ill. App. filed July 31, 1922.

1,558,436, 1,558,437. ELECTRICAL DISCHARGE APPARATUS AND PROCESS FOR PREPARING AND USING THE SAME; I. Langmuir, New York, N. Y. App. filed Oct. 16, 1913.

1,558,447. ELECTROMAGNETIC FISHING TOOL; C. H. Beach, Racine, Wis. App. filed Nov. 7, 1921. To locate hidden objects.

1,558,448. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Schenectady, N. Y. App. filed Aug. 2, 1922.

(Issued October 27, 1925)

1,558,499. INSULATOR CONSTRUCTION; J. M. Peck, Lima, N. Y. App. filed Jan. 8, 1923.

1,558,521. TELEPHONE-EXCHANGE SYSTEM; E. von Nostitz, Brooklyn, N. Y. App. filed Feb. 21, 1921. Central-energy type.

1,558,524. MEANS FOR ACCURATELY REPRODUCING ANGULAR MOVEMENTS; E. M. Hewlett and W. W. Willard, Schenectady, N. Y. App. filed Sept. 15, 1921.

1,558,525. MEANS FOR REPRODUCING POSITION; E. J. Murphy and L. P. Hutt, Schenectady, N. Y. App. filed Dec. 16, 1921.

1,558,528. OVERHEAD ELECTRICAL CONDUCTOR SYSTEM; H. B. Wrenn and A. S. O'Donoghue, Cleveland, Ohio. App. filed May 17, 1923.

1,558,534. TELEPHONE CIRCUITS; J. Davidson, Jr., Montclair, N. J. App. filed Oct. 1, 1924. Operators' telephone-set circuit.

1,558,535. SECRET WIRELESS; P. B. Delany, South Orange, N. J. App. filed Feb. 1, 1922.

1,558,541. MONITORING SET FOR TELEGRAPH REPEATERS; J. Herman, New York, N. Y. App. filed June 27, 1923.

1,558,564. ELECTRICAL TESTING SYSTEM; H. Nyquist, Elmhurst, N. Y. App. filed July 16, 1921. For determining the degree of unbalance between two networks.

1,558,583. LIGHT BULB; W. E. Bock, Chicago, Ill. App. filed July 19, 1922.

1,558,610. PRINTING MECHANISM FOR PRINTING-TELEGRAPH RECEIVERS; G. S. Hiltz, Brooklyn, N. Y. App. filed March 28, 1923.

1,558,628. SAFETY LOCK FOR KNIFE SWITCHES; W. F. Purcell, Buffalo, N. Y. App. filed Jan. 12, 1925.

1,558,650. ELECTRIC SWITCH; J. S. Thompson, San Francisco, Cal. App. filed Dec. 10, 1923. Disconnecting switch for high-voltage lines.

1,558,658. PORTABLE ELECTRIC LIGHT STAND; S. Wimmer, West New York, N. J. App. filed Sept. 26, 1924.

1,558,672. TELEPHOTOGRAPHIC SENDING APPARATUS; R. Hart, Los Angeles, Cal. App. filed July 2, 1923.

1,558,705. ELECTRIC LOCK; J. H. Milligan, East Holliston, Mass. App. filed April 5, 1924.

1,558,729. CLIPPER; L. J. Wahl, Sterling, Ill. App. filed April 7, 1924. Vibratory type.

1,558,758. INDUCTION COIL; D. A. Reynolds, West Hoboken, N. J. App. filed Nov. 22, 1917. For use on a calling system.

1,558,806. ELECTROMECHANICAL POWER-TRANSMISSION MECHANISM; A. C. Hess, Jr., Union, Ore. App. filed Dec. 7, 1921. For motor-driven vehicles.

1,558,812. AUTOMATIC TELEPHONE SYSTEM; E. Jacobsen, Chicago, Ill. App. filed June 11, 1917.

1,558,822. SELECTOR SWITCH; C. I. Baker, Elizabeth, N. J. App. filed Nov. 2, 1923. For use in automatic-telephone system.

1,558,823. WATER HEATER; G. M. Bayne, Hamilton, Ontario, Canada. App. filed Oct. 23, 1923.

1,558,826. ELECTRICAL TESTING SYSTEM; M. C. Beebe, New York, N. Y. App. filed Feb. 21, 1920. Magnetic-detecting system.

1,558,830. ELECTRON DISCHARGE DEVICE; W. R. Brough, East Orange, N. J. App. filed May 13, 1922.

1,558,832. TROLLEY POLE; L. F. Burnham, Wilkinsburg, Pa. App. filed July 5, 1922.

1,558,834. TELEPHONE SYSTEM; W. W. Carpenter, Queens, N. Y. App. filed Aug. 31, 1923. Machine switching.

1,558,841. TRANSFORMER WINDINGS; H. L. Cole, Wilkinsburg, Pa. App. filed Aug. 6, 1923.

1,558,852. ARC-EXTINGUISHING DEVICE; O. H. Escholz, Wilkinsburg, Pa. App. filed Feb. 20, 1922.

1,558,859. ELECTROLYTIC CONDENSER; C. L. Fortescue, Pittsburgh, Pa. App. filed June 17, 1920. As for lightning arresters, rectifiers and the like.

1,558,862. CONTROLLING MECHANISM; E. S. Gibson, Ridgewood, N. J. App. filed Sept. 20, 1923. For telephone-exchange system.

1,558,872. TELEPHONE SYSTEM; E. C. Helwig, Hackensack, N. J. App. filed March 3, 1923. Link circuits in automatic and manual switching systems.

1,558,875. SYSTEM OF CONTROL; L. J. Hibbard, Wilkinsburg, Pa. App. filed Dec. 17, 1919. Control and interlocking of the operation of a plurality of alternating-current commutator motors during the accelerating method.

1,558,883. VACUUM TUBE; W. G. Housekeeper, New York, N. Y. App. filed April 20, 1921.

1,558,891. ELECTRIC HEATING UNIT; A. D. Keene, Pittsburgh, Pa. App. filed Dec. 13, 1923. For resistance furnaces.

1,558,905, 1,558,906. STREET SIGNAL LAMP; F. Milliken, Lawrence, N. Y. App. filed Feb. 21, 1922.

1,558,909. SELECTIVE CIRCUITS; H. W. Nichols, Maplewood, N. J. App. filed Oct. 29, 1921. For wave transmission.

1,558,915. COMBINED CIGARETTE AND CIGAR LIGHTER; L. Pengilly, Stockton, Cal. App. filed Jan. 12, 1924.

1,558,926. PORTABLE POWER UNIT; K. Rottgardt, Dahlem, near Berlin, Germany. App. filed Aug. 26, 1921.

1,558,936. ELECTRICAL CONTROL FOR PAPER MACHINES; V. D. Simons, Chicago, Ill. App. filed July 15, 1920.

1,558,937. DYNAMO-ELECTRIC MACHINE; J. Slepian, Wilkinsburg, Pa. App. filed Aug. 15, 1910. Means for producing wattless electric currents.

1,558,938. ELECTRICAL APPARATUS; J. Slepian, Wilkinsburg, Pa. App. filed Oct. 15, 1923. Having component parts adapted to perform commutating functions.

1,558,944. TELEPHONE SWITCH; H. B. Taylor, Westfield, N. J. App. filed Aug. 17, 1923. Co-ordinate type.

1,558,961. MANUFACTURE OF FILAMENTS OR CATHODES FOR ELECTRIC LAMPS, THERMIONIC TUBES AND THE LIKE; W. R. Bullimore, London, England. App. filed Nov. 24, 1924.

Financial and Corporate

Utility Stocks Advance

National Power & Light Moves Sharply Up as Plans Are Made to Take Carolina Power & Light

NEVER in the history of organized markets in this country has trading been so broad or heavy or prices so high as during the week under review. Fresh records were made both on the New York Stock Exchange and the New York Curb Market, and, as may have been supposed, strength in the industrials was accompanied by greater activity and advances in power and light stocks. While evidence appears of a tightening in money rates and the Boston Federal Reserve Bank has raised its rediscount rate from 3½ to 4 per cent, money still remains relatively cheap and nowhere is dear money expected soon.

Perhaps the most interesting news of the week in the utility department was the announcement that National Power & Light, after splitting its common shares on the basis of fifteen to one, was taking over Carolina Power & Light. Fifteen shares of National Power & Light new are offered for each share of Carolina Power & Light Company's common stock. Apparently this action was discounted in the market for the two stocks, for the market in the two issues came together after an advance during the week of eighteen points in National Power & Light and forty-two points in Carolina Power & Light. Lehigh Power Securities, another member of the Electric Bond & Share group, rose thirteen points during the week. Electric Bond & Share itself, on the other hand, improved its position by two points.

Other gains of the week were made by American Power & Light, Electric Investors, Inc., Galveston-Houston preferred, Power Corporation of New York and American Gas & Electric. Declines were registered by American Light & Traction, which lost no less than sixteen points, and Northern States Power.

Stock Split-Up of Paper Company Approved

The stockholders of the International Paper Company have approved the proposal of the management for a readjustment of the company's capital set-up. The common shares numbering 500,000 of $100 par value will be increased to 750,000 shares of no par value, and the preferred stock will be increased from 500,000 to 750,000 shares of $100 par value. Of the 500,000 shares of common stock of $100 a share par value, 250,000 shares are outstanding. The company is planning to exchange 250,000 shares of the new no-par-value stock for the outstanding common stock on a share-for-share basis and to offer an additional 250,000 shares of no-par-value common stock to present shareholders on a share-for-share basis at $50 a share. The sale of this stock will give the company an additional $10,000,000. Approximately $4,000,000 of this money will be used for participation in the financial plan for the further development of the New England Power Company system, the details of which were published in the October 10 and October 17 issues of the ELECTRICAL WORLD.

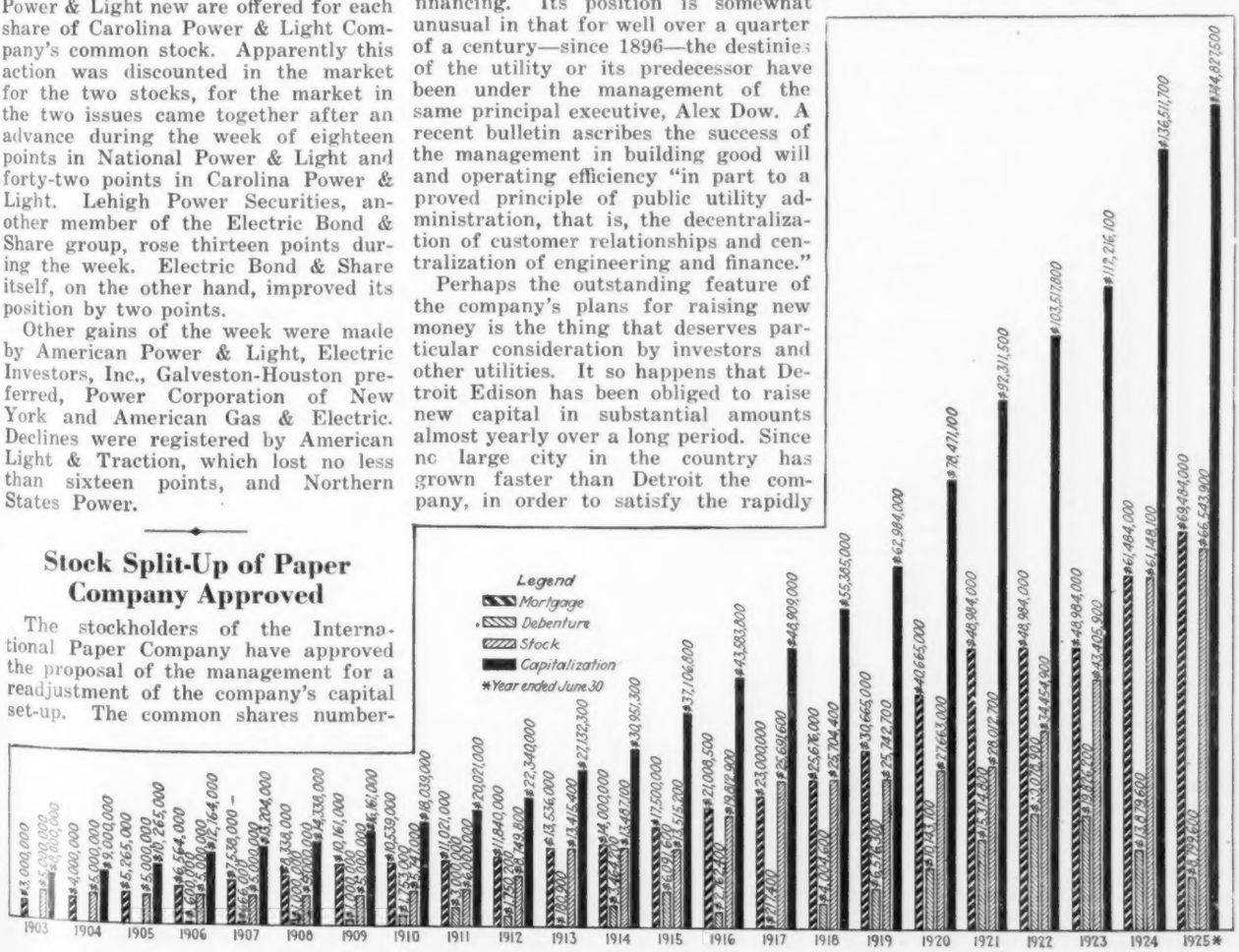
Detroit Edison's Improved Set-Up

Able Management and Expert Financing Have Made Company's Securities a Favorite with Conservative Investors Who Understand Values

BY PAUL WILLARD GARRETT

WITHIN a concentrated area in and around Detroit the Detroit Edison Company, which serves a territory about 100 miles long and 40 miles wide, has distinguished itself for unusual success in operations and in financing. Its position is somewhat unusual in that for well over a quarter of a century—since 1896—the destinies of the utility or its predecessor have been under the management of the same principal executive, Alex Dow. A recent bulletin ascribes the success of the management in building good will and operating efficiency "in part to a proved principle of public utility administration, that is, the decentralization of customer relationships and centralization of engineering and finance."

Perhaps the outstanding feature of the company's plans for raising new money is the thing that deserves particular consideration by investors and other utilities. It so happens that Detroit Edison has been obliged to raise new capital in substantial amounts almost yearly over a long period. Since no large city in the country has grown faster than Detroit the company, in order to satisfy the rapidly increasing demands for service, has had to enlarge its capitalization steadily and enormously for years. The total capitalization has, for example, grown in substantial amount in every year since 1903, having ad-



INCREASE IN CAPITALIZATION OF DETROIT EDISON COMPANY SINCE 1903

vanced from $8,000,000 in that year to $144,827,500 on June 30, 1925. Conditions have not always been favorable for financing through sale of common stock or through flotation of mortgage bonds, but in such circumstances Detroit Edison in the past has been successful in its financing by an alternative method; it has financed through the disposition of convertible debenture bonds.

So far $34,272,900 of debentures have been issued in the company's history, and, it is interesting to note, $25,487,700 of these had been converted into common stock up to June 30, 1925. Since the stock holds a market position above parity, and since conversions are continuing, it is figured that the entire debenture issues will be retired through conversion or call.

Detroit Edison's present capitalization, $144,827,500, is made up in about equal parts of mortgage bonds and capital stock; to be specific, there are $69,484,000 in mortgage bonds, $66,543,900 in capital stock and $8,799,600 in debentures. Not many large companies in the country, and not many utilities large or small that have grown rapidly, can show so conservative a balance between fixed obligations and capital stock as Detroit Edison. The company is constantly improving its financial structure, not only in the proportion of bonds to stock but in the earnings position.

With the kilowatt-hour output per capita up from 54 in 1905 and 464 in 1915 to 886 in 1924, the company's gross earnings have grown by leaps and bounds. Persistent yearly gains in the last decade, for example, have swelled the gross earnings from $7,759,932 in 1915 to $34,163,286 in 1924 and $18,628,758 for the first six months of 1925. Net income after taxes likewise has grown persistently from $2,948,713 in 1915 to $10,265,562 in 1924 and $6,070,937 for the first half of the current calendar year. Interest charges are being earned in the neighborhood of three times.

An impressive balance sheet is that presented by the Detroit Edison Company on June 30, 1925, with current assets of $15,438,571 against current liabilities of $7,209,236. Fixed assets total $143,129,705 and all assets $170,455,779. With net tangible assets of $2,112 for each $1,000 of mortgage debt, and with the capital stock valued on the books at $110, Detroit Edison Company's bonds and stock have achieved a position of rare investment merit.

New Capital Issues

During the past week the Midland Utilities Company made an offering of serial gold notes, maturing in from one to three years, at prices to yield from 4.75 per cent to 5.10 per cent. The financing involved a total of $3,000,000. These notes will be a direct obligation of the company and will constitute the only funded debt to be outstanding at this time.

Southern Cities Utilities Company floated an issue of fifteen-year 6½ per cent gold bonds, series A, amounting to $1,500,000 at 98 and accrued interest, to yield over 6.70 per cent. Upon completion of the present financing the company will own all of the common capital stocks of the West Virginia Utilities Company, controlling the Wheeling Public Service Company, Southern Cities Power Company, Fayetteville Electric Light & Power Company, Sequatchie Valley Light & Power Company, Southern States Ice Company, Electric Illuminating & Equipping Company and Mills & Lupton Supply Company.

Bonds Called in November.—Among the electric light and power issues called for payment in advance of maturity are the following:

Issues	Amount	Due
Southeastern Power & Light, 6s.	$7,500,000	1929
Metropolitan Edison, 8s.....	1,593,000	1935
City Light & Water, 6s	1,000,000	1926
Orange County Hydro-Elec., 7s.	589,000	1942
Ventura County Power, 6s.....	348,000	1936
Mississippi River Power, 7s*....	564,500	1935
Connecticut Light & Power, 7s.*	81,500	1951
National Light, Heat & Power, 5s*	42,000	1935
Power Corp. of N. Y., B 6s*....	10,000	1942

*Not entire issues.

Widening Savings-Bank Investment Field

Utility Securities Offer Safety of Investment, High Return and Marketability and Should Be Legalized as Savings Bank Investments

By E. J. Beckett
Assistant Treasurer Pacific Gas & Electric Company, San Francisco

PUBLIC utility securities, particularly those of electric light and power companies, are enjoying an era of popularity never before experienced in the life of the industry. Over two million investors in the United States now own the stocks and bonds of electrical utilities, these companies in the last eleven years alone having sold over three-quarters of a billion dollars' worth of stock direct to 950,000 investors under the customer-ownership plan, aside from the hundreds of millions of dollars of utility issues which are annually distributed through investment banking channels. The insurance companies, as well as national banks, well informed and careful investors, have added enormously to their holdings of public utility bonds in recent years. The accompanying tabulation of national-bank investments in railroad bonds and in the bonds of public utility companies indicates the very large relative increase in the latter class of investment during the past fifteen years.

INVESTMENTS OF NATIONAL BANKS*

	Railroad Bonds	Other Public Service Corporation Bonds
1909	$342,525,000	$151,999,000
1914	341,690,000	218,215,000
1924	573,571,000	397,560,000
Increase in fifteen years ...	$231,046,000	$245,561,000
Percentage increase	67.5	161.5

*Figures extracted from annual reports of the Comptroller of the Currency.

In view of these facts and of the generally recognized strength and stability of the public utility industry, it seems inconsistent to record that the savings banks of the country, which are responsible for the safe investment of savings deposits aggregating many billions of dollars, are only in a comparatively few states legally permitted to invest their funds in bonds of public utilities. The latest report of the Comptroller of the Currency states that June 30, 1924, there were 13,972,000 depositors in the mutual and stock savings banks of the United States, with total deposits of $8,439,855,000. It is only through the safe and intelligent investment of this immense amount of money that the banks are able to make interest payments to their millions of depositors, and yet they are debarred by law in many of the wealthiest and most populous states in the Union from investing in what is unquestionably one of the largest, most progressive, most essential and most stable industries in the entire country.

Present statutory restrictions governing savings banks investment are widely divergent and full of inconsistencies. However, the laws of most states permit of placing these funds, with certain limitations, in United States government bonds, state, county and municipal issues, railroad bonds and real estate mortgages. Only in California, Colorado, Connecticut, Maine, Massachusetts, Michigan, New Hampshire, New Mexico, Rhode Island and Vermont are savings banks specifically permitted to invest in utility issues able to comply with certain conditions; and of these states, Michigan restricts investment in public utility securities to bonds of companies incorporated in that state, and Colorado, Massachusetts and New Mexico allow only investment in first mortgage bonds.

Utility Bonds Desirable Investments

The ideal investment combines absolute security of principal and a ready marketability with as high a yield as it is possible to obtain with safety, and in these respects the better grade of utility company bonds offer an exceptionally desirable field. United States government bonds, for example, possess the attributes of safety and of marketability, but the yield is lower than the interest rate which the majority of savings banks pay to their depositors. State and municipal bonds also afford a comparatively low yield, largely on account of their tax-free feature, which is of no particular benefit to institutional investors. First-class real estate mortgages fulfill the requirements of safety and reasonable yield, yet generally possess only a limited degree of marketability. Railroad bonds as a general rule afford a smaller return than the same grade of utility issues. The admissibility of

public utility bonds as legal investments for savings banks in all states would permit these institutions to diversify their investments to a larger degree than is now possible and would also enable them to derive a higher average rate of yield upon their investments.

This in turn would react to the advantage of their depositors, since the interest rate paid upon deposits is primarily governed by the return which the banks are able to earn upon the funds so invested. The electric and gas companies of the country would also benefit materially from such a situation. If only 15 per cent of all savings deposits in banks were permitted to be invested in the bonds of utility companies, this would mean that these institutions could absorb two and one half billion dollars' worth of these securities. As conditions now exist, less than one billion dollars' worth of utility issues are now held by the banks of the country, of which not more than one-fourth are owned by mutual and stock savings banks.

The electrical industry is, generally speaking, alive to the tremendous possibilities offered by the extension of the field for savings-bank investments to include public utility securities. A committee under the chairmanship of M. S. Sloan, president of the Brooklyn Edison Company, has for some time been actively engaged, in co-operation with savings-banks associations and similar bodies, in an effort to secure amendments of the laws of certain Eastern states so as to permit of modifying the existing statutory restrictions relative to this subject. The laws of Connecticut were very recently revised so as to legalize for savings-bank investments the bonds of certain electric and telephone companies. While the statute as now amended is perhaps unnecessarily rigid in its restrictions, it represents at least a start in the right direction. Somewhat similar proposed legislation in Massachusetts, however, quite recently failed of enactment.

Interests of Depositors a Factor

No intelligent person will question the desirability of so restricting the investment of savings-bank funds as to safeguard absolutely the savings of their millions of depositors. At the same time, the interests of the savings-bank depositors themselves will be best served by permitting such latitude in investment as will at least assure a fair rate of return. In the case of public utility bonds the tendency in some quarters to limit investment to closed first mortgages or underlying issues of electrical companies will permit of placing funds only in those securities which are already in the greatest demand among all classes of investors and which yield a comparatively very moderate return. It is an indubitable fact that admission to legality as savings-bank investments of other utility issues which are not necessarily absolute first mortgages, but which are nevertheless amply secured by physical assets and possessed of an assured earning capacity and subject to reasonable restrictions as to the issuance of additional bonds, would not only be beneficial to the banks by permitting the purchase of bonds yielding, say, from 5 per cent to 6 per cent, but would be of immense advantage to public utilities by opening a very large and hitherto unavailable market for the modern type of open-end issue which now forms the vehicle with which a great many companies are doing their senior financing.

Institutional investors such as insurance companies and banks have for a great many years been seeking the establishment of definite standards by which the investment value of securities may be gaged. In this connection a prominent investment banking house, after an analysis of the existing statutes and of the standards now utilized by various large insurance companies and other institutional investors in their selection of public utility bonds, has suggested the following guiding principles:

1. The bonds must be issued by a public utility company supplying electric light and power or gas service, or electric light and power in combination with traction service where the latter does not contribute more than 25 per cent of the net operating earnings.

2. The company must serve well-diversified types of customers, and it or its predecessors must have shown healthy expansion over a period of at least ten years.

3. The company must operate either under the control of a state public utility commission or under an exclusive and satisfactory franchise which by its terms extends at least three years beyond the maturity date of the bonds under consideration.

4. If the bonds are secured by an open overlying mortgage, it must cover all property of the company now owned and hereafter acquired, covering as a first lien some important unit. Such mortgage must provide for the issuance of further bonds sufficient not only for the refunding of all underlying liens par for par, but also for future additions and betterments, at not over 75 per cent of their actual cash costs or reasonable value, whichever is less. If the bonds are secured by an underlying mortgage, it must cover, as a first closed mortgage, used and useful portions of the property and be provided for in refunding.

5. The total mortgage debt shall not exceed 60 per cent of the reasonable value of physical property.

6. Net earnings for a period of thirty-six consecutive months out of the previous thirty-eight months shall have been equal to at least one and three-quarters times all present interest charges, including interest on bonds about to be issued, and for twelve consecutive months out of the previous fourteen months shall have been equal to at least twice all present interest charges, including interest on bonds to be issued.

7. The company shall show net operating earnings available for interest charges of at least $200,000 per annum.

8. Management must be broad-minded and efficient.

The foregoing tests, while they are, of course, merely suggestive in nature, appear to be well balanced, sound and practical. They are not intended to reflect the opinion of any single individual, but to represent rather the accumulated experience and judgment of a large number of investors, and they might at least form a working basis for legislation governing savings-bank investments in bonds of utility companies.

Opinions may differ as to the stringency of the provisions which should be made to govern this class of investment, but when one finds that sixteen of the forty-eight states have no statutory regulations covering the investment of savings-bank funds, in many cases leaving this vital responsibility entirely to the discretion of the officers of these institutions, one cannot escape the conviction that, as a mere matter of protection to depositors, legislation definitely outlining in what manner their money may be invested is desirable.

States having no legislation covering investment of savings-bank funds, or permitting investment at discretion of savings-bank officials:

Alabama	Mississippi
Arkansas	Nebraska*
Delaware	North Carolina
Georgia	Oklahoma
Illinois	South Dakota
Kansas	Tennessee
Kentucky	Utah
Maryland	Virginia

States having legislation limiting investment of savings-bank funds, but not permitting investment in public utility securities:

Arizona	New York
Florida	North Dakota
Idaho	Oregon
Indiana	Pennsylvania
Iowa	South Carolina
Louisiana	Texas
Minnesota	Washington
Missouri	West Virginia
Montana	Wisconsin
Nevada	Wyoming
New Jersey	

States specifically permitting investment in public utility securities able to comply with certain restrictions:

California	Vermont
Connecticut	Colorado‡
Maine	Massachusetts‡
Michigan†	New Mexico‡
New Hampshire	Ohio‖
Rhode Island	

*Bonds of known marketable value when approved by State Banking Board.
†Limited to bonds of Michigan utilities.
‡First mortgage bonds.
‖Bonds of any regularly incorporated company.

Necessity of Legislation

A study of the situation revealed by the accompanying table and a consideration of the highly essential part played by the public utilities in our national development, the tremendous amount of financing which is annually undertaken to provide adequate service and the splendid opportunity for safe and profitable investment afforded by the purchase of their securities justify the conclusion that the adoption of definite and, as far as possible, standardized legislation permitting the investment of savings-bank deposits in public service corporation bonds is a matter of far-reaching importance, not only to the utilities, but to the millions of savings-bank depositors who comprise so large a proportion of the American public. The benefits of legislative action along these lines are so obvious that it is almost surprising that more of the wealthy and progressive states have not long ago provided machinery for legalizing public utility bonds. The real cause of delay is undoubtedly occasioned not by any doubts as to the safety and desirability of these securities for savings-bank investments, but by lack of initiative on the part of the banks. Bankers are proverbially conservative, and in many quarters the lack of support on this question springs from an attitude of indifference—their present investments are yielding sufficient to pay their depositors' interest, so why worry? The general public, which in the final analysis is the most interested party, has little or no information on the subject. The average savings-bank depositor probably never stops to think

that the traditional 4 per cent he receives is really not much more than 2 per cent, contrasting the purchasing power of today's dollar with that of a few years ago, and that, in all fairness, the banks to which he intrusts his money ought to make every effort consistent with safety to give him more real value than he is receiving. The burden of stimulating legislative regulation of savings banks' investments in conformity with the trend of modern development as regards the utility industry necessarily falls upon the industry itself, and educational work along these lines within the ranks of the industry, as well as outside, is desirable.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of September:

Name of Company	Gross Earnings for September 1925	1924
Asheville Power & Light	$99,754	$94,300
Carolina Power & Light	345,554	229,669
Columbus Electric & Power*	220,935	172,984
El Paso Electric*	200,938	193,280
Havana Elec. Ry., Lt. & Pwr.	1,252,517	1,210,271
Idaho Power	266,777	280,539
New England Co. Power System	630,134	557,254
Public Service Corp. of N. J.	7,542,144	7,014,854
Yadkin River Power	181,607	183,491

*August.

Dividends Declared

Name of Company	Per Cent	When Payable
American Power & Light, com	.25	Dec. 1
American Power & Light, com.*	.....	Dec. 1
Central Arkansas Ry. & Light, pf.	1¾	Dec. 1
Central Indiana Power, pf.	1¾	Dec. 1
Cleveland Electric Illum., 6% pf.	1½	Dec. 1
Community Power, 2d pf.	$2	Dec. 1
Duquesne Light, 1st pf. A	1¾	Dec. 15
Federal Light & Traction, com.	.35	Jan. 2
Federal Light & Traction, pf.	1¾	Dec. 1
Georgia Railway & Power, com.	1	Dec. 1
Georgia Railway & Power, 8% pf.	2	Jan. 1
Georgia Railway & Power, 7% pf.	1¾	Jan. 1
Louisville Gas & Elec. (Del.), Class A	.43¾	Dec. 26
Maytag Company (No. 1)	.50	Dec. 1
National Power & Light, com.	$1.50	Dec. 1
Nebraska Power, pf.	1¾	Dec. 1
North American Edison, pf.	$1.50	Dec. 1
Oklahoma Gas & Electric, pf.	1¾	Dec. 15
Portland Electric Power, pf.	1¾	Dec. 1
Radio Corporation, pf.	1¾	Jan. 1
Southwestern Power & Light, pf.	1¾	Dec. 1
Tampa Electric	$2.50	Nov. 16
Timken Roller Bearing	.75	Dec. 5
Timken Roller Bearing, extra	.25	Dec. 5
Utica Gas & Electric, pf.	1¾	Nov. 15
Wisconsin Power & Light, pf.	$1.75	Dec. 15

*One-fiftieth share common stock.

Virginia Electric & Power Company Offers Preferred Stock.—Stone & Webster, Inc., Blair & Company, Inc., Brown Brothers & Company and Blodget & Company are offering $5,000,000 Virginia Electric & Power Company (formerly Virginia Railway & Power Company) 7 per cent cumulative preferred stock at $102.50 a share, par value $100. This stock is issued in exchange for outstanding preferred stock under a merger agreement and does not represent new financing. Virginia Electric & Power Company, into which the Spottsylvania Power Company was merged, as announced in the October 24 number of the ELECTRICAL WORLD, furnishes through ownership or control electric light and power, transportation and gas service in Richmond, Norfolk, Portsmouth, Williamsburg, Suffolk, Petersburg, Hopewell, Fredericksburg and Ashland, Va., and Weldon and Roanoke Rapids, N. C., and surrounding territory with an aggregate estimated population of about 500,000.

Ten-Million-Dollar Loan Made to German Utility.—The National City Company during the past week made an offering of direct mortgage gold bonds of the Rhine-Westphalia Power Corporation totaling $10,000,000, the price being 94 and interest, to yield over 7.53 per cent. More than $3,000,000 of this issue is being placed in Europe. The corporation and subsidiaries serve a territory in the valleys of the Ruhr and the lower Rhine, the most important industrial sections of Germany. Proceeds of the issue will be used to construct the high-tension transmission system between the Ruhr district and the Alps and to expand the corporation's general transmission and distribution system.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 7	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f68	62	75¼
Adirondack Pwr. & Lt.—7% pf.	100¼	98	106
Adirondack Pwr. & Lt.—8% pf.	105	103	115
Adirondack Pwr. & Lt., com.—50	75	31	98
Ala. Pwr., pf.	103¼	97¼	103
Allis-Chalmers Mfg. pf.	f107	103¼	108¼
Allis-Chalmers Mfg., com.	f 90	71¼	95
Amer. & Foreign Pwr., pf. 25% pd.	f132¼	114¼	142
Amer. & Foreign Pwr., 7% pf.	r92¼	87	94
Amer. & Foreign Pwr., com.	f 43¼	27¼	51¾
Amer Bosch Magneto, com.—no par	f 32¼	26¼	54¼
Amer. Brown, Boveri, pte., stk.	f 50¼	50	53¾
Amer. Elec. Pwr., pf.	c 100¼	91¼	104¼
Amer. Gas & Elec., 6% pf.—no par	91¼	85	91
Amer. Gas & Elec., com.—no par	80	70	85
Amer. Lt. & Trac., 6% pf.	107	93	109
Amer. Lt. & Trac., com.	279	139	288
Amer. Pwr. & Lt., 6% pf.	94	84	95
Amer. Pwr. & Lt., com.—no par	62	52	67
Amer. Pub. Serv., 7% pf.	90	88	94
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	79	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	78	70	103
Amer. Superpwr., pf.—25	k26¼	24¼	27¼
Amer. Superpwr., Class A—no par	f 36	....	....
Amer. Superpwr., Class B—no par	f38¼	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	100¼	97¼	103
Amer. Wtr. Wks. & Elec., com.	f54¼	34¼	68¼
Appalachian Pwr., 7% pf.	101	92	100
Appalachian Pwr., 1st pf., 7%	101	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	83	75	87
Arizona Pwr., com.	33	15	34¼
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	97	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	j103	98	103
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50¼	....	....
Assoc. Gas & Elec., pf.—$6—no par	f 85	....	....
Assoc. Gas & Elec., Class A	f 35¼	....	....
Babcock & Wilcox, com.	f148	....	....
Birmingham Elec. pf.—$7—no par.	101	98	101¼
Blackstone Valley Gas & Elec., com.—50	87	....	....
Brazilian Trac., Lt. & Pwr., com.	f 77¼	....	....
Broad River Pwr., pf.	94	90	97
Brooklyn Edison, com.	f153¼	120¼	156¼
Buffalo Gen. Elec., com.—no par	k58	50	77
Buffalo, Niagara & East. Pwr., pf.—25	j23¼	....	....
Buffalo, Niagara & Eastern Pwr., com.	j29¼	....	....
Carolina Pwr. & Lt., pf.—$7—no par	104¼	100	107
Carolina Pwr. & Lt., com.	445	290	445
Central Ariz. Lt. & Pwr., pf.	100	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98¼
Central Ill. Pub. Serv., 6% pf.	86	84	93
Central Ind. Pwr., 7% pf.	87	88	95
Central Pwr. & Lt., pf.	92¼	88	95
Central States Elec., 7% pf.	94	87	98
Central States Elec., com.	220	70	225
Century Elec., com.	b103	103	110
Chicago Fuse Mfg., com., no par	a32	27¼	39¼
Cincinnati Gas & Elec., com.	c90¼	82	90¼
Cities Service, 6% pf.	83¼	80	84
Cities Service, pf. B—10	f 7¼	....	....
Cities Service, pf. BB—100	f 78¼	....	....
Cities Service, com.—20	38¼	34	43
Cities Service, Bks. Shrs.—10	17¼	16¼	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	f112	104¼	113¼
Columbia Gas & Elec., com.—no par	f 82	45¼	86
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	f100	....	....
Columbus Elec. & Pwr., com.	f145	....	....
Columbus Ry., Pwr. & Lt., pf. A	97	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr., & Lt., com.	150	114	150
Commonwealth Edison, com.	a138	130¼	141¼
Commonwealth Pwr., 6% pf.	84	80	85¼
Commonwealth Pwr., com—no par	34	30¼	43¼
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	111	105	110
Cons. Gas of N. Y., pf.	f 58	....	....
Cons. Gas of N. Y., com.—no par	f 92¼	74¼	95¼
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	c108	105	110¼
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	c111	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	c124¼	122	127¼
Cons. Gas, Elec. Lt. & Pwr. of Balti., com.—no par	c 44	32	47¾
Cons. Utilities of Dela., 7% pf.	k85	80	84
Consumers Pwr., 6% pf.	95¼	90	97
Consumers Pwr., 6.6% pf.	101	97	102
Continental Gas & Elec., 7% pte. pf	94¼	85	97
Continental Gas & Elec., 7% pr. pf.	94¼	89	95
Continental Gas & Elec., com—no par	140	77	145
Crocker Wheeler, com.	15	21	28
Crocker Wheeler, pf.	..	65	80
Dallas Pwr. & Lt., 7% pf.	103	100	102¾
Dayton Pwr. & Lt., 6% pf.	95¼	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	f141	110	159¼
Dubilier Condenser & Radio, com.	f 12¼	....	....
Dubuque Elec., 7% pf.	90	80	90
Duquesne Lt., 7% pf.	111	104	112
East. Tex. Elec., 6% pf.	100	100	105
East. Tex. Elec., com.—no par	80	70	75¼
Edison Elec. Illum. of Boston, com.	d208¼	200	213
El Paso Elec., com.	f 74	....	....
El Paso Elec., pf.	f100	....	....
Elec. Bond & Share, 6% pf.	j103¼	101¼	106¾
Elec. Bond & Share Sec., com.—no par	j 68	56¾	80¼
Elec. Investors, 6% pf.—no par	92	95	96
Elec. Investors, com.—no par	66¼	30	68
Elec. Investors, 10% pd. receipts	48	15	50
Elec. Pwr. & Lt., etfs. pf.	f 91¼	89¼	94
Elec. Pwr. & Lt., etfs., 40% pd.	f107	100	110
Elec. Pwr. & Lt., etfs. full pd.	f107¼	100¼	110¾
Elec. Pwr. & Lt., etfs., com.	f 31¼	17¾	40¼
Elec. Storage Battery, com.—no par	f 72¼	60¼	75¼
Elmira Wtr., Lt. & R.R., 7% pf.	96	93	98
Emerson Elec., pf.	b101¼	95	101
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.—no par	99	100	103
Engr. Pub. Serv., com.—no par	19¼	19¼	30
Eureka Vacuum Cleaner, com.—no par	f 50¼	50	55¼
Fairbanks Morse, com.	f 49¼	32¼	51¾
Federal Lt. & Trac., com.	f 28	26	36
Federal Light & Traction, pf.	f 83¼	82¼	86¼
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	j106	99¼	107¼
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	25	20	40
Gen. Elec., com.	f320¼	227¼	337¼
Gen. Elec., special—10	f 11¼	10¼	11¼
Gen. Gas & Elec., 6% pf.—no par.	220	72	240
Gen. Gas & Elec., 7% pf.	165	120	175
Gen. Gas & Elec., com.—no par	210	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	130	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par.	140	104¼	180
Gen. Gas & Elec. (Del.) com. A no par.	62	42	64¼
Gen. Gas & Elec. (Del.) com. B no par.	56	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par.	95	97¼	100
Gen. Gas & Elec. (Del.) A pf. 8% no par.	107	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par.	94	88	96
Ga. Lt., Pwr., & Rys., 6% pf.	77	74	85
Ga. Lt., Pwr. & Rys., com.	60	25	74
Ga. Ry. & Elec. .5% pf.	k 83	78¼	84¼
Ga. Ry. & Elec. .com	k124¼	115¼	115¼
Ga. Ry. & Pwr., 8% pf.	f112	....	....
Ga. Ry. & Pwr., 7% pf.	f101¼	....	....
Ga. Ry. & Pwr., 6% pf.	130	62	110
Ga. Ry. & Pwr., com.	136	62	140
Gt. Western Pwr., 7% pf.	j101¼	....	....
Havana Elec. Ry., Lt. & Pwr., com.	k236	112	246
Havana Elec. Ry., Lt. & Pwr., pf.	f112	112	116
Hurley Machine, com.—no par	a 52	41¼	56
Idaho Pwr., 7% pf.	100¼	97¼	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	97	92¼	98
Int. Combustion Engr., com.—no par	f 55¼	31¼	58¼
Int. Utilities, class A—no par	35	33¼	36¼
Int. Utilities, class B—no par	f 7¼	....	....
Interstate Pwr., pf., $7, no par	90	90	95
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	95	90	96
Jersey Central Pwr. & Lt., com.—no par	45	15	50
Johns-Manville, com.—no par	f160	....	....
Kansas Gas & Elec., 7% pf.	j101	97¼	102
Kelvinator Corp., com.—no par	f 84¼	....	....
Kentucky Hydro-Elec., com.	a 91¼	85¼	92¼

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. iBid, low, high, Tuesday, Nov. 10. jBid, low, high, Wednesday, Nov. 11. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 7	Low 1925	High 1925
STOCKS—Continued			
Kentucky Sec., 6% pf.	73	67	78
Kentucky Sec., com.	82	77	87
Kentucky Utilities, 6% pf.	86	82	95
Kings County Ltg., 7% pf.	f100	....	....
Laclede Gas Lt., com.	f166	110½	178
Lehigh Pwr. Sec., cap.—no par	f173	82	179
Long Island Ltg., 7% pf.	104½	100	105
Long Island Ltg., com.—no par	134	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par	38	28½	49½
Maytag Mfg., com.	f 23½	23	26½
Memphis Pwr. & Lt., pf., $7, no par.	102½	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	96
Metropolitan Edison, pf., $7, no par.	104	100	110
Middle West Utilities, 7% pf.	a 97½	91½	98½
Middle West Utilities, 7% pr. lien pf.	a107	98	107½
Middle West Utilities, com.—no par	a117	92½	125
Midland Utilities, pr. ln. pf.	a 99½	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	97	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86	83½	87
Minn. Pwr. & Lt., 7% pf.	f101	97½	102
Miss. Pwr. & Lt., pf.	f100	....	....
Miss. River Pwr., 6% pf.	f 94	....	....
Miss. River Pwr., com.	117	37	124½
Montana Pwr., com.	f 84½	64	99½
Montana Pwr., pf.	f110	109	117
Montreal Pwr., com.	f212½	....	....
Mountain States Pwr., pf.	f 93	....	....
Mountain States Pwr., com.	f 27	....	....
National Carbon, com.	k124	120	130
National Carbon, pf.	k94½	....	....
National Elec. Pwr., pf.	a 94½	94	96½
National Lt., Ht. & Pwr., 5% pf.	72	40	72
National Lt., Ht. & Pwr., com.—no par	25	11	30
National Pwr. & Lt., pf., $7—no par	100½	95	99
National Pwr. & Lt., com.—no par.	442	185	464
National Pub. Serv., 7% pf.	f 92	....	....
National Pub. Serv., pfd.	f 98	....	....
National Pub. Serv., A com.—no par	f 23½	....	....
National Pub. Serv., B com.—no par	15½	14	20
Nebraska Pwr., 7% pf.	f102½	98½	103½
Nevada-Calif. Elec., com.	f 11	....	....
N. J. Pwr. & Lt., 7% pf.	103	92	102
New Orleans Pub. Serv., 7% pf.	100	94	102
New Orleans Pub. Serv., com.—no par.	e	....	....
N. Y. Central Elec., 7% pf.	k 30	31	38½
Niagara Falls Pwr., 7% pf.—25	97	96	101
Niagara, Lock. & Ont. Pwr., 7% pf.	27½	27½	29
Niagara, Lock. & Ont. Pwr., com.—no par.	k106	101½	110
Nizer Corp., A.—no par.	k 63	60	73
Nizer Corp., B.—no par.	f 84	....	....
No. Amer., 6% pf.—50.	f 84	....	....
No. Amer., com.—10	f 48½	46½	50½
No. Caro. Pub. Serv., pf.—87—no par.	f 67½	41½	75
No. N. Y. Utilities, 7% pf.	90	90	96
No. Ohio Pwr., com.—no par.	f101½	....	....
No. Ohio Trac. & Lt., 6% pf.	15	5	19
No. Ont. Lt. & Pwr., pf.	73	64	75
No. Ont. Lt. & Pwr., com.	76	68	78
No. States Pwr., 7% pf.	46	41	52
No. States Pwr., com.	99½	95	100
No. Texas Elec., 6% pf.	136	103	141
No. Texas Elec., com.	50	60	75
Ohio Gas & Elec., 7% pf.	40	40	70
Ohio Pwr., 6% pf.	90	87	100
Ohio Pub. Serv., 7% pf.	93	85	95
Ohio River Edison, 7% pf.	97½	97	100
Oklahoma Gas & Elec., pf.	97	93½	100½
Pacific Gas & Elec., 6% pf.	f93	....	....
Pacific Gas & Elec., com.	97	92	99
Pacific Pwr. & Lt., 7% pf.	f132½	102½	137½
Parr Shoals Pwr., 6% pf.	f100	97½	102
Penn Central Lt. & Pwr., pf.—no par	92	90	100
Penn-Ohio Elec., 7% pf.	e 70	60	71
Penn-Ohio Pwr. & Lt., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 8% pf.	97	91	10o
Penn Pwr. & Lt.—87—no par.	102	101	110
Penn Pub. Serv., 7% pf.	f104	98½	106
Penn Pub. Serv., 6% pf.	96	90	100
Penn Wtr. & Pwr., cap.	85	80	90
Phila. Co., pf.—50.	f161	126½	185½
Phila. Co., com.	k 49	45½	49
Phila. Elec., com.	f 60½	51½	64½
Pittsburgh Utilities, pf.	e 54½	37½	57½
Portland Elec. Pwr., 7% pf.	f 15	12½	17½
Portland Elec. Pwr., 6% pf.	98	95	99
Portland Elec. Pwr., com.	72	70	80
Portland Ry., Lt. & Pwr., pf.	46	40	53
Portland Ry., Lt. & Pwr., com.	k 72	....	....
Pwr. Corp. of N. Y., 7% pf.	k 41	....	....
Pwr. Corp. of N. Y., com.—no par	k110	96	112
Pwr. Sec., pf.—no par.	70	15	89½
Pwr. Sec., com.—no par.	20	20	55
Pub. Serv. of N. J., 7% pf.	15	8	30
Pub. Serv. of N. J., 8% pf.	f104	99	105½
Pub. Serv. of N. J., com.—no par.	117	108½	119
Pub. Serv. of N. J., 6% pf.	a 80½	62½	87½
Pub. Serv. of No. Ill., 6% pf.	a 99	92	100
Public Serv. of No. Ill., 7% pf.	a110	102	110½
Pub. Serv. of No. Ill., com.—no par	a127	107½	128½
Pub. Serv. of No. Ill., com.	a126½	118	128½
Pub. Serv. of Okla., 7% pf.	93	87	95
Pub. Serv. Elec. & Gas, 6% pf.	k 97½	92½	97½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	f 84	....	....
Puget Sound Pwr. & Lt., com.	48	49	61
Radio Corp. of Amer., pf.—50.	f 46½	45½	54
Radio Corp. of Amer., com.—no par	f 48½	46	77½
Republic Ry & Lt., pf.	85	70	85
Republic Ry. & Lt., com.	59	49	65
Rochester Gas & Elec., 5% pf.	95	80	98
Servel Corp., Class A.	f 33	....	....
Servel Corp., Class B—no par.	k 50	35	56
Sierra Pacific Elec., com.	f 25	....	....
Sioux City Gas & Elec., 7% pf.	f 99	....	....
Southeastern Pwr. & Lt., 7% pf.—no par.	97	90	100
Southeastern Pwr. & Lt., com—no par	33	28	34½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110½	105	107½
So. Calif. Edison, 6% pf.	97	90	95½
So. Calif. Edison, com.	139	102	149
Southern Cities Utilities, 7% pf.	83	77	100
Southern Cities Utilities, com.	55	30	71
Southern Pwr. & Lt. of Md., pf.	f107	....	....
Southern Pwr. & Lt. of Md., com.	f 32	....	....
Southwestern Pwr. & Lt., A.	f 47	....	....
Southwestern Pwr. & Lt., B.	f 22	....	....
Southwestern Pwr. & Lt., 7% pf.	99½	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	f 55½	50½	56½
Standard Gas & Elec., 7% pf.	100	96	100
Standard Gas & Elec., com.—no par	f 58½	40½	64
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superheater, com.—No par.	142	120	152
Tampa Elec., com.	f272	....	....
Tenn. Elec. Pwr., 6% pf.	85	80	85
Tenn. Elec. Pwr., 7% pf.	98	93	103
Tenn. Elec. Pwr. pf.—$6—no par.	k 80	72	84
Tenn. Elec. Pwr., com.—no par.	k 65	....	....
Tex. Pwr. & Lt., 7% pf.	f104	99½	106
Tide Water Pwr., 8% pf.	f 98	....	....
Timken Roller Bearing, com.	f 55½	37½	59½
Toledo Edison, 8% pf.	112	109	114
Toledo Edison, 7% pf.	100	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	85	82	85
United Gas & Elec., 6% pf.	92	80	94
United Gas & Elec., com.—no par.	51	26	54½
United Gas & Elec. (N. J.), 5% pf.	62	55	65
United Gas Impr.—50.	f117	79½	120½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par.	92	83	99
United Lt. & Pwr., com., A—no par.	156	42	166½
United Lt. & Pwr., com., B—no par.	155	49	100
Utah Pwr. & Lt., 7% pf.	f 99	97½	101½
Utica Gas & Elec., 7% pf.	102	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	90	90	97
Utilities Pwr. & Lt., com. B—no par	19½	12	22
Vermont Hydro-Elec., 7% pf.	92	87	96
Virginia Pwr., 7% pf.	101	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	k145	64½	145
Wagner Elec., pf.	b 87	79	92
Wagner Elec., com.—no par	b 37	26	50
Washington Wtr. Pwr., com.	120	110	140
West Mo. Pwr., 7% pf.	f 97	....	....
West Penn., 7% pf.	k 96	94	100
West Penn., com.	f111	97	145
West Penn Pwr., pf.	k108½	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50.	41	38	47
Western Elec., 7% pf.	k 83	110	117½
Western Pwr., 7% pf.	96	84	....
Western Pwr., com.—no par.	87	84	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	f 19	....	....
Westinghouse Elec. & Mfg., com.—50.	f 74½	66½	84
Weston Elec. Instrument, Cl. A.	f 27½	19½	28½
Weston Elec. Instrument, com.	f 19½	9	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	k 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A.	77	76	88
Worthington Pump, pf. B.	62	58	76½
Worthington Pump, com.	f 43	35½	79½
Yadkin River Pwr., 7% pf.	f104	98	106
Yale & Towne, com.—25.	f 62	62	70½

BONDS

Abitibi Pwr. & Paper	6s	1940	100½	98	101½
Adir. Elec. Pwr.	5s	1962	99½	97½	100½
Adir. Pwr. & Lt.	6s	1950	104½	102½	105½
Adir. Pwr. & Lt.	5s	1930	97	94	97
Ala. Pwr.	5s	1946	98	96	100
Ala. Pwr.	5s	1951	95½	92½	97½
Ala. Pwr.	6s	1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s	1962	107	86	105
Aluminum Co. of Amer.	7s	1933	106½	106½	107½
Amer. Bosch Magneto	8s	1936	k103	86	101
Amer. Gas & Elec.	5s	2007	91	90	93½
Amer. Gas & Elec.	6s	2014	98	96½	98½
Amer. Pwr. & Lt.	6s	2016	96½	94	98
Amer. Pub. Serv.	6s	1942	98	94	99½
Amer. Wtr. Wks. & Elec.	5s	1934	95½	92½	98
Anaconda Copper	6s	1929	102½	102½	104
Anaconda Copper	6s	1953	101	99½	102½
Anaconda Copper	7s	1938	105½	99½	105½
Appalachian Pwr.	5s	1941	98½	96	99½
Appalachian Pwr.	6s	2024	93	86½	94½
Appalachian Pwr.	7s	1936	105	105½	106½
Arizona Pwr.	6s	1933	100	97½	101½
Arizona Pwr.	6s	1947	95½	90	96
Ark. Central Pwr.	6s	1948	100½	98½	102½
Ark. Lt. & Pwr.	6s	1945	102½	100	104½
Ark. Lt. & Pwr.	6s	1954	98½	92½	99½
Assoc. Gas & Elec.	6s	1965	93½	92	96
Assoc. Gas & Elec.	6½s	1954	101	94½	106
Binghamton Lt., Ht. & Pwr.	5s	1946	98	94½	98½
Birmingham Elec.	6s	1954	101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s	1954	87½	85	89½
Broad River Pwr.	6½s	1934	100	99	102
Brooklyn Edison	5s	1949	101½	99½	103
Brooklyn Edison	6s	1930	104½	103½	106
Buffalo Gen. Elec. 1st	5s	1939	101½	100½	101½
Buffalo Gen. Elec. 1st & Ref.	5s	1939	101	100	100½
Burlington Ry. & Lt.	5s	1932	94½	90	96
Butte Elec. & Pwr.	5s	1951	99½	99	100½
Calif. Gas & Elec.	5s	1937	100½	98	101½
Canadian Lt. & Pwr.	5s	1949	40	36	62
Canton Elec.	5s	1937	99½	99	100½
Carolina Pwr. & Lt.	5s	1938	99½	98½	100½
Carolina Pwr. & Lt.	6s	1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s	1953	99½	98½	100½
Central Ark. Ry. & Lt.	5s	1928	98½	98½	100
Central Ga. Pwr.	5s	1938	95½	93	97
Central Ill. Lt.	5s	1943	98½	94	99½
Central Ill. Publ Serv.	5s	1952	90	84½	92½
Central Ill. Pub. Serv.	5½s	1950	96	96½	98
Central Ill. Pub. Serv.	6s	1944	99½	96½	101½
Central Ind. Pwr.	6s	1947	98½	95½	99½
Central Ia. Pwr. & Lt.	6s	1944	99	97	100½
Central N. Y. Gas & El.	5s	1941	95	94½	97½
Central Pwr. & Lt.	6s	1946	100½	97½	101½
Central Pwr. & Lt.	6½s	1952	101½	94	102
Central States Elec.	5s	1926	k 99	98	100
Chattanooga Ry. & Lt.	5s	1956	84	81	85
Cincinnati Gas & Elec.	5s	1956	101½	98½	....
Cincinnati Gas & Elec.	5½s	1967	103½	100½	105
Cities Service	6s	1966	90½	90	91
Cities Service	7s B	1966	176	150½	178½
Cities Service	7s C	1966	125½	111	128
Cities Service	7s D	1966	101½	98½	106½
Cities Service	7s E	1966	111	111	112½
Cities Service Pwr. & Lt.	6s	1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s	1952	84	74	85½
Cleveland Elec. Illum.	5s	1939	101½	100	102
Cleveland Elec. Illum.	5s	1954	100½	97½	101
Cleveland Elec. Illum.	7s	1941	110	109	111½
Colorado Pwr.	5s	1953	95½	93	96½
Columbia Gas & Elec.	5s	1927	99½	99½	100½
Columbia Ry., Gas & El.	5s	1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s	1937	85	83	88
Columbus, Dela. & Marion Elec.	6s	1937	95	91	98
Columbus Elec. & Pwr.	6s	1947	f102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s	1941	103	101½	105
Commonwealth Edison	5s	1943	k102	99½	102½
Commonwealth Edison	5s	1953	99½	98½	101
Commonwealth Edison	5s	1954	99½	98	101
Commonwealth Pwr.	6s	1947	102½	97½	103½
Community Pwr. & Lt.	6s	1950	96	94½	98
Conn. Ry. & Ltg.	4½s	1951	k 89½	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s	1962	80½	75½	82½
Consol. Elec.	5s	1955	96½	94	98½
Consol. Gas of N. Y.	5½s	1945	103½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935	c 97½	93½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949	106	104½	108
Con. Gas, Elec. Lt. & Pwr. of Balti.	5½s	1952	103½	101½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s	1965	99½	98	100½
Con. Gas, Elec. Lt. & Power of Baltimore	5½s	1952	c 104	102½	105½
Consumers Elec. Lt. & Pwr.	5s	1936	94	93	96½
Consumers Pwr.	5s	1936	100	99	100½
Consumers Pwr.	5s	1952	97	90½	100
Consumers Pwr.	5½s	1954	102½	99	101½
Continental Gas & Elec.	5s	1927	100	99½	100½
Continental Gas & Elec.	6s	1947	99½	98	100
Continental Gas & Elec.	6½s	1964	98	96½	101
Continental Gas & Elec.	7s	1954	103½	99	103½
Cumberland County Pwr. & Lt.	5s	1942	94½	92	96½
Dallas Pwr. & Lt.	6s	1949	104½	103	105½
Dayton Ltg.	5s	1937	99½	98½	100
Dayton Pwr. & Lt.	5s	1941	99½	97	100
Defiance Gas & Elec.	5s	1942	95	88½	97
Denver Gas & Elec.	5s	1949	97½	97½	100
Denver Gas & Elec. Lt.	5s	1951	93	92	95½
Des Moines Elec.	5s	1938	98	98	100
Detroit Edison	5s	1933	102	99½	102½
Detroit Edison	5s	1940	102½	99½	102½
Detroit Edison	5s	1949	100	97½	101½
Detroit Edison	5s	1955	k 99½	97½	100
Detroit Edison	6s	1932	144½	110½	155
Detroit Edison	6s	1940	107½	106½	108½
Detroit Edison	7s	1928	k150½	125	156½
Detroit Edison	7s	1929	k150½	114	150
Detroit Edison	7s	1930	143	121½	158½
Dominion Pwr. & Trans	5s	1932	95	95½	98½
Driver-Harris	8s	1931	95	88	97
Duquesne Lt.	6s	1942	101	97½	102
Duke-Price Pwr.	6s	1949	101	98½	103
Duquesne Lt.	6s	1949	105½	104½	107½
Duquesne Lt.	5½s	1949	105	104	106
Durham Pub. Serv.	7s	1949	100	97½	101½
East Penn. Elec.	6s	1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s	1929	100	97½	100½
East. Tex. Elec.	5s	1942	f 94½	....	....
Economy Lt. & Pwr.	5s	1956	98	96	99½
Edison Elec. Illum. of Bkln.	4s	1939	92	89	95½
Edison Elec. Illum. (N. Y.)	5s	1995	101½	99½	103
El Paso Elec.	5s	1932	f102	....	....
El Paso Elec.	6s	1950	f 95½	....	....
Elec. Pwr. Corp. (Germany)	6½s	1950	88	86½	88½
Elmira Wtr., Lt. & R. R.	5s	1956	95	92½	96½
Empire Dist. Elec.	5s	1949	91	86½	91½
Erie Ltg.	5s	1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s	1932	98½	96	100
Federal Lt. & Trac.	5s	1942	92½	88	101½
Federal Lt. & Trac.	6s	1942	102	96½	103
Federal Lt. & Trac.	6s	1954	92½	91½	94½
Ft. Smith Lt. & Trac.	5s	1936	76½	76½	82½
Ft. Worth Pwr. & Lt.	5s	1931	99	99	100½
Galveston Elec.	5s	1940	91	86½	93½
General Elec.	3½s	1942	89	83	90½
General Elec.	5s	1952	k107½	101½	107½
Georgia Carolina Pwr.	5s	1952	85½	82	90
Ga. Lt., Pwr. & Rys.	5s	1941	88	86½	90½
Ga. Ry. & Elec.	5s	1932	98	98½	100½
Ga. Ry. & Elec.	5s	1949	92	88	94½
Ga. Ry. & Pwr.	5s	1954	93½	89½	96
Ga. Ry. & Pwr.	6s	1947	102	100½	103½
Ga. Ry. & Pwr.	7s	1941	104½	105	107
German Gen. Elec.	7s	1945	96	92	96½
Great Cons. Elec. Pwr. (Japan)	6½s	1950	86	86	86½
Great Cons. Elec. Pwr. (Japan)	7s	1944	90½	87½	91½
Great Falls Pwr.	5s	1940	102½	99½	102½
Great Northern Pwr.	5s	1935	98	96	99
Great Western Pwr.	5s	1946	98½	95	99½
Great Western Pwr.	5½s	1955	98	96	99
Great Western Pwr.	6s	1949	100½	100	102½
Great Western Pwr.	6s	1952	101	99½	102½
Hamburg Elec.	7s	1935	95½	95½	95½
Havana Elec. Ry., Lt. & Pwr.	5s	1954	95	85½	95½
Holtwood Pwr.	6s	1954	103½	100	104½
Houston Ltg. & Pwr.	5s	1931	99½	98½	100
Houston Ltg. & Pwr.	5s	1953	92	90½	95½
Houston Ltg. & Pwr.	5½s	1954	99½	97	101½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco. *i*Bid, low, high, Tuesday, Nov. 10. *j*Bid, low, high, Wednesday, Nov. 11. *k*Latest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies			Bid Price Saturday, Nov. 7	Low 1925	High 1925
BONDS (Continued)					
Hydraulic Pwr	5s	1951	101	99½	102
Hydraulic Pwr	5s	1950	101	100	103
Idaho Pwr	5s	1947	96½	93	97½
Ill. Elec. Pwr	6s	1943	102	99½	103½
Ill. Pwr	5s	1933	93½	93	95½
Ill. Pwr. & Lt	6s	1953	100½	100½	102½
Ill. Pwr. & Lt	7s	1953	102½	99	102
Ind. Elec	6s	1947	98	97	99½
Ind. Gen. Serv	5s	1948	95	92	97½
Ind. Lighting	4s	1958	80½	78	83
Indiana & Mich. Elec	5s	1957	98½	97½	99½
Indiana & Mich. Elec	5s	1955	95	95	98
Ind. Pwr	7⅛s	1941	*k*105½	104	106
Ind. Service	5s	1950	89½	86½	92
Ind. Service	6s	2020	85	73	88½
Ingersoll-Rand	5s	1935	99½	92	99½
Interstate Elec	6s	1933	95	95	99½
Interstate Pwr	6s	1944	97½	95	99½
Interstate Pwr	7s	1934	99½	97	100½
Interstate Pub. Serv	6s	1948	98	96	100½
Iowa Ry. & Lt	5s	1932	97½	97	99½
Jersey Cent. Pwr. & Lt.	5½s	1945	95½	95	98
Kansas City Pwr. & Lt.	5s	1952	99¼	95½	102
Kansas Elec. Pwr	6s	1937	100	97½	102
Kansas Elec. Pwr	6s	1943	100	97½	102
Kansas Gas & Elec	6s	1952	102	98½	103½
Kansas Gas & Elec	6s	2022	91	86½	94½
Kentucky Utilities	6s	1949	100½	97	101½
Kings County Elec. Lt. & Pwr	5s	1937	101½	99	103
Kings County Elec. Lt. & Pwr	6s	1997	119½	114½	120½
Kings County Ltg	5s	1954	98½	89	101½
Kings County Ltg	6½s	1954	107	103½	108½
Knoxville Ry. & Lt	5s	1946	92½	88	95½
Laclede Gas Lt	5s	1934	100	98½	101½
Laclede Gas Lt	5½s	1953	100½	95½	102
Laurentian Pwr	6s	1936	100	96	100½
Laurentide Pwr	6s	1936	*k*99	96	100
Laurentide Pwr	5s	1946	99½	97	100½
Laurentide Pwr	6s	1936	*k*99	....	....
Lehigh Pwr. Sec. (notes)	6s	1927	101	100½	101½
Lincoln Gas & Elec	5s	1941	91	92½	95½
Long Island Ltg	5s	1936	99½	98½	100½
Long Island Ltg	6s	1954	100	99½	102
Long Island Ltg	6s	1948	104½	102	105½
Long Island Ltg	6s	1954	99	99½	102
Los Angeles Gas & Elec	5s	1939	99	98	101½
Los Angeles Gas & Elec	5½s	1943	98	94	99½
Los Angeles Gas & Elec	5½s	1947	98	96	99½
Los Angeles Gas & Elec	5½s	1944	97½	95½	99½
Los Angeles Gas & Elec	6s	1942	102½	101½	104½
Louisiana Pwr	6s	1944	97½	97	99
Louisville Gas & Elec	5s	1952	97	90½	99½
Louisville Gas & Elec	5½s	1954	101½	99	102
Lower Austrian Hydro Elec	6½s	1944	85½	85½	86½
Luzerne County Gas & Elec	5s	1948	98	97	99½
Luzerne County Gas & Elec	7s	1944	103	99½	104½
Luzerne County Gas & Elec	6s	1954	102½	99	105
Madison River Pwr	5s	1935	100	99½	101
Manila Elec	7s	1942	102¾	97½	102¾
Manila Elec. Ry. & Ltg	5s	1953	89	85	92
Manitoba Pwr	7s	1941	103	98½	104½
Memphis Pwr. & Lt	5s	1948	98½	95	99½
Metropolitan Edison	6s	1952	104½	101½	106
Metropolitan Edison	5s	1953	96½	91½	97
Metropolitan Pwr	6s	1953	102	100	104
Michigan Lt	5s	1946	98	97½	100
Michigan No. Pwr	5s	1941	96	95½	97
Milwaukee Elec. Ry. & Lt	5s	1926	100	99½	101½
Milwaukee Elec. Ry. & Lt	4½s	1931	96½	94½	97
Milwaukee Elec. Ry. & Lt	5s	1951	97½	94	100
Milwaukee Elec. Ry. & Lt	6s	1961	88½	84½	92½
Milwaukee Elec. Ry. & Lt	6s	1953	100½	98½	104
Minn. Pwr. & Lt	5s	1955	95	95	97
Minn. Pwr. & Lt	6s	1950	103½	101½	105½
Miss. River Pwr	5s	1951	98½	96½	100½
Miss. River Pwr	7s	1935	102	102	104
Mo. Edison Elec	5s	1927	*k*100	100	100½
Mobile Elec	5s	1946	96	91	97½
Montana Pwr	5s	1943	100½	97½	100½
Montgomery Lt & Wtr. Pwr	5s	1943	*k* 93	86½	93½
Montreal Lt., Ht & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht & Pwr.	5s	1933	98½	98½	101
Montreal Pub. Serv	5s	1942	94½	89	94½
Mountain States Pwr.	6s	1938	98½	96½	100½
Nashville Ry. & Lt	5s	1953	97	94	98
Nashville Ry. & Lt	5s	1958	89½	84	88½
Nassau Lt. & Pwr	5s	1927	99½	98	101
Nassau & Suffolk Ltg	5s	1945	89	82	91
National Pwr. & Lt	7s	1972	100	97	104½
National Pub. Serv	6½s	1955	94	94	96½
Nebraska Pwr	5s	1949	99½	97	99½
Nebraska Pwr	6s	2022	96½	89½	96½
Nevada-Calif. Elec	6s	1946	99	96½	100½
Nevada-Calif. Elec	6s	1950	99	96½	100½
New England Pwr	5s	1951	101	100½	103
New Jersey Pwr. & Lt.	5s	1936	95½	92½	97½
New Orleans Pub. Serv.	4½s	1935	86	83½	88½
New Orleans Pub. Serv.	5s	1952	91½	90	92
New Orleans Pub. Serv.	5s	1955	90½	88½	92½
New Orleans Pub. Serv.	6s	1949	92	86½	93½
N. Y. & Queens Elec. Lt. & Pwr	5s	1930	100	99½	101
N. Y. & Westchester Ltg	4s	2004	78	76	81
N. Y. & Westchester Ltg	5s	1954	96	93	97
New York Edison	6½s	1941	114½	112	115½
New York Edison	5s	1944	101½	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr	5s	1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr	4s	1949	88½	86	90½
N. Y. State Gas & Elec	5½s	1962	100½	96	101½
Newport News & Hampton Ry., Gas & Elec	5s	1944	88	84	93
Niagara Falls Pwr	5s	1932	102	100	103
Niagara Falls Pwr	6s	1932	105⅝	103½	106½
Niagara Falls Pwr	6s	1950	104½	105½	106½
Niagara, Lock. & Ont. Pwr	5s	1954	98½	104½	110
Niagara, Lock. & Ont. Pwr	5s	1955	98½	97½	100
Niagara, Lock. & Ont. Pwr	6s	1958	*f*109½	104½	110½
Norfolk Ry. & Lt	5s	1949	94	93	95½
No. Amer. Edison	6s	1952	102⅝	96½	102½
No. Amer. Edison	6½s	1948	104½	100½	106
No. Amer. Lt & Pwr	7s	1954	99½	97	100
North Caro. Pub. Serv.	5s	1934	90	89	93½
North Caro. Pub. Serv.	6s	1954	94	91½	96
North Caro. Pub. Serv.	6½s	1944	98	96	100
North Shore Elec	5s	1940	99½	97½	100
No. Calif. Pwr	5s	1948	99½	98½	100½
No. Ind. Gas & Elec	5s	1929	99	97	100½
No. Ind. Gas & Elec	6s	1952	102	99½	103½
Northern N. Y. Utilities	5½s	1949	99	96½	100½
No. Ohio Trac. & Lt.	4s	1933	86	82	87½
No. Ohio Trac. & Lt.	5s	1956	81	78	87
No. Ohio Trac. & Lt.	6s	1926	98½	98½	100
No. Ohio Trac. & Lt.	6s	1947	93½	91	97
No. Ontario Lt. & Pwr.	6s	1931	98½	95½	99½
No. States Pwr.	6½s	1933	131	105½	136½
No. States Pwr. (notes)	6½s	1933	103½	99½	104½
No. States Pwr.	6s	1948	102½	101	104½
No. States Pwr	6s	1941	105½	103	107½
No. States Pwr	5s	1941	97½	93	99½
No. Tex. Elec	5s	1940	65	80½	82½
Northwestern Elec	6s	1935	101	101½	102½
Northwestern Pub. Serv.	6½s	1948	99	97½	100½
Ohio Pwr.	5s	1952	92½	89½	96
Ohio Pwr.	6s	1953	102½	101	104½
Ohio Pwr.	6s	2024	95	88½	95½
Ohio Pwr.	7s	1951	106	106½	107½
Ohio Pub. Serv	5s	1954	91	87	93
Ohio Pub. Serv	6s	1953	100½	98	101½
Ohio Pub. Serv	7⅛s	1946	111½	108	112½
Ohio Pub. Serv	7s	1947	110½	107½	111½
Ohio River Edison	6s	1948	102	98½	103
Okla. Gas & Elec	5s	1950	92	93½	96
Okla. Gas & Elec	6s	1940	96½	96	98½
Ontario Pwr. of Niagara Falls	5s	1943	99½	98	100½
Ontario Transmission	5s	1945	99	97	99½
Ozark Pwr. & Wtr	5s	1952	76	75	81
Pacific Coast Pwr	5s	1940	99½	97½	99½
Pacific Gas & Elec	5s	1942	96½	93½	99
Pacific Gas & Elec	5s	1955	*k* 93½	94	95½
Pacific Gas & Elec	5½s	1952	101	97½	102½
Pacific Gas & Elec	6s	1941	105½	103½	106
Pacific Lt. & Pwr	5s	1951	99½	98½	100½
Pacific Lt. & Pwr	5s	1942	99½	98	101½
Pacific Pwr. & Lt	5s	1930	99½	98	100
Pacific Pwr. & Lt	5s	1953	*k* 96½	....	....
Parr Shoals Pwr	5s	1952	94	92½	97
Paterson & Passaic Gas & Elec	5s	1949	99½	96	100½
Penn Central Lt. & Pwr	6s	1953	103	102	104½
Penn Edison	5s	1946	96½	94	97½
Penn Elec	6½s	1954	98½	96	99½
Penn. Elec	6s	1955	93½	93½	95
Penn Ohio Elec	6½s	1938	104½	99½	105
Penn Ohio Pwr. & Lt	5½s	1954	97½	95	99½
Penn Ohio Pwr. & Lt	6s	1939	97½	94	99
Penn Pwr. & Lt	5s	1952	97½	95	98½
Penn Pwr. & Lt	5s	1953	97½	95	98½
Penn Pwr. & Lt	6s	1953	104½	102½	105½
Penn Pwr. & Lt	7s	1951	105½	106	107½
Penn Pub. Serv	5s	1954	95	93	96½
Penn Pub. Serv	6s	1947	103	103	105½
Penn Wtr. & Pwr	5s	1940	101½	99½	102
Penn Wtr. & Pwr	5½s	1953	102	99½	103
Phila. Co	6s	1944	104½	101½	105
Phila. Co	5½s	1938	98	93½	100
Phila. Co	5s	1951	94½	95	97
Phila. Co	5s	1949	*k*102	94½	104½
Phila. Elec	6s	1941	*c*107	106	108½
Phila. Elec	5s	1966	*c*102½	100	104½
Phila Elec	4s	1966	*c* 84½	83	85
Phila. Elec	5s	1960	*c*100½	100	104
Phila. Elec	5½s	1947	*c*106½	103½	107
Phila. Elec	5½s	1953	*c*106½	104½	107½
Portland Elec. Pwr	6s	1947	99½	96½	100½
Portland Gen. Elec	5s	1935	99½	98½	100½
Portland Ry., Lt. & Pwr.	5s	1942	88½	84½	92
Portland Ry., Lt. & Pwr.	6s	1947	99	94	100½
Portland Ry., Lt. & Pwr.	7½s	1946	105½	104½	108
Potomac Edison	6s	1949	98½	96	100
Potomac Edison	6½s	1948	102	99	103½
Potomac Elec. Pwr	5s	1929	99½	99	100½
Potomac Elec. Pwr	5s	1936	99½	98½	100
Power Corp. of N. Y.	6s	1942	99½	97½	101
Power Corp. of N. Y.	6½s	1942	104	99½	103½
Power Securities	6s	1949	*t*79	....	....
Pub. Lt. & Pwr	5s	1945	70	64	79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92	96½
Pub. Serv. Co. of Colo.	6s	1953	99	98	101
Pub. Serv. Co. of Colo.	7s	1933	101	98½	102½
Pub. Serv. Corp. of N. J.	5s	1959	104½	103½	105½
Pub. Serv. Corp. of N. J.	6s	1944	99½	95	100
Pub. Serv. Co. of No. Ill.	5s	1956	96	91	97½
Pub. Serv. Co. of No. Ill.	5½s	1962	101	96½	102½
Pub. Serv. Co. of No. Ill.	5½s	1964	101	96½	102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½	103
Pub. Serv. Elec. & Gas.	5½s	1959	103½	98½	105½
Pub. Serv. Elec. & Gas.	5½s	1964	103½	99½	105
Public Utilities (Evansville, Ind.)	6s	1929	99½	99	101
Puget Sound Pwr	5s	1933	98½	98½	100½
Puget Sound Pwr. & Lt.	5½s	1949	99½	96½	100½
Quebec Pwr	6s	1953	101½	98½	102½
Queensborough Gas & Elec	5s	1952	99	96½	100½
Queensborough Gas & Elec	6s	1953	104	101	105
Rio de Janeiro Tram., Lt. & Pwr	5s	1935	92½	85	91½
Robbins & Myers	7s	1952	60	57½	73½
Rochester Gas & Elec	5½s	1948	103½	102	104½
Rochester Gas & Elec	7s	1946	110½	109½	111
Rockford Elec	5s	1939	99½	98	101
St. Joseph Ry., Lt., Ht. & Pwr	5s	1937	91	85½	92
St. Paul Gas Lt	5s	1944	100½	98½	100½
St. Paul Gas Lt	5½s	1954	101½	98	102½
Salt River Valley Wtr	6s	1938	*t*100	....	....
Salmon River Pwr	5s	1952	100½	98½	101½
San Antonio Gas & Elec	5s	1949	97	96	98½
San Antonio Pub. Serv.	6s	1952	101½	99½	104
San Diego Cons. Gas & Elec	5s	1939	100	98	101
San Diego Cons. Gas & Elec	6s	1939	101½	99	103
San Joaquin Lt. & Pwr.	5s	1945	98½	98	100
San Joaquin Lt. & Pwr.	6s	1950	102½	101	103½
San Joaquin Lt. & Pwr.	6s	1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s	1954	100½	99	101
Savannah Elec. & Pwr.	7½s	1941	*t*104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945	94½	90½	94½
Scranton Electric	5s	1937	101½	99½	101½
Seattle Elec	5s	1930	*t*100	....	....
Seattle Elec	5s	1929	*t* 99	....	....
Seattle Elec	5s	1939	92½	90	93½
Seattle Ltg	5s	1949	91½	85½	92
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950	103½	101½	104
Shawinigan Wtr. & Pwr.	6s	1950	104½	104	106½
Siemens & Halske	7s	1928	97	92½	99½
Siemens & Halske	7s	1935	95	90½	96½
Sierra & San Francisco Pwr	5s	1949	75½	75	80
Sierra & San Francisco Pwr	6s	1949	89	87	93½
Sioux City Gas & Elec	6s	1947	101½	99	102
Sioux City Gas & Elec	6s	1949	101½	99	102
So. Caro. Gas & Elec	6s	1942	84	87	93
So. Caro. Gas & Elec	6s	1932	75	83	88
Southeast Pwr. & Lt	6s	2025	88½	88	89
So. Cal. Edison	5s	1939	99½	99½	101
So. Cal. Edison	5s	1944	95	92	96½
So. Cal. Edison	5½s	1944	101½	98½	102
So. Cal. Edison	6s	1943	102	100½	104
So. Cal. Edison	6s	1944	104½	102½	105½
So. Cities Utilities	8s	1931	99	99	102
Southern Colo. Power	6s	1947	99½	93½	99½
So. Public Utilities	5s	1943	99½	97½	100½
So. Sierras Pwr	6s	1936	102½	102	104½
So. Utilities	6s	1933	102	97½	102½
So. Wisconsin Pwr	5s	1938	90	88	93
Southwestern Gas & Elec	5s	1932	96½	94	98
Southwestern Gas & Elec	6s	1957	96½	89	97½
Southwestern Pwr. & Lt.	5s	1943	94½	90	97
Southwestern Pwr. & Lt.	6s	2022	92	88½	94½
Southwestern Utilities	8s	1936	97	96	102
Springfield Ry. & Lt.	5s	1926	99½	98½	100½
Standard Elec. of Cal.	5s	1939	98½	98½	100½
Standard Gas & Elec	6s	1935	99½	91	101
Staten Island Edison	6½s	1953	104½	104	106½
Syracuse Ltg	5s	1951	100	97	101½
Syracuse Ltg	5½s	1954	101½	100½	103
Tampa Elec	5s	1933	*t*99	....	....
Tenn. Elec. Pwr	6s	1947	102½	99½	104½
Tenn. Pwr	5s	1962	94½	90	96½
Tex. Pwr. & Lt	5s	1937	98	97	99½
Tex. Pwr. & Lt	6s	2022	97	90	96½
Tide Water Pwr	6s	1942	99½	98½	101
Tide Water Pwr	7s	1937	98½	97½	101½
Toho Elec. Pwr. (Japan)	7s	1955	90½	87	91½
Tokyo Elec. (Japan)	6s	1928	98½	98½	99½
Toledo Edison	5s	1947	98½	97	100
Toledo Edison	7s	1941	109½	108½	110
Toledo Gas Elec. & Htg.	5s	1935	96½	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	97½	97½	100½
Topeka Edison	5s	1930	98½	97	100
Topeka Ry. & Lt	5s	1933	95½	90½	96½
Trenton Gas & Elec	5s	1949	99½	98	100
Tri-City Ry. & Lt	5s	1930	98½	96½	99½
Twin State Gas & Elec	5s	1953	92½	84	94½
Tyrol Hydro-Elec. Pwr.	7½s	1955	96½	94½	97
Union Elec. Lt. & Pwr.	5s	1932	101	99½	102
Union Elec. Lt. & Pwr.	5s	1933	99½	98½	101
Union Elec. Lt. & Pwr.	5s	1954	98½	97½	100
Union Elec. Lt. & Pwr.	5½s	1954	102	100	104
United Elec. of N. J.	4s	1949	87½	85	88½
United Elec. Lt. & Pwr.	4½s	1929	*k* 98½	98½	99
United Gas & Elec	6s	1945	99	96	101
United Lt. & Pwr. notes	5½s	1928	99½	98	100
United Lt. & Pwr.	5½s	1959	93½	89½	97
United Lt. & Pwr.	6½s	1974	95½	92½	97½
United Lt. & Rys.	5s	1932	95½	93	97½
United Lt. & Rys.	6s	1926	99½	100½	101½
United Lt. & Rys.	6s	1952	98½	95½	100½
United Lt. & Rys.	6s	1973	89	87	92
United Pwr. & Lt.	6s	1944	101½	99	103
Utah Lt. & Trac	5s	1944	88	83½	91½
Utah Pwr. & Lt.	5s	1944	94½	91	98½
Utah Pwr. & Lt.	6s	1944	102½	102	104½
Utah Pwr. & Lt.	6s	2022	92½	88½	94½
Utica Elec. Lt. & Pwr.	5s	1950	101½	100½	102
Utica Gas & Elec	5s	1957	101½	98½	103
Vermont Hydro-Elec.	6s	1929	100	98½	100½
Vicksburg Lt. & Trac.	5s	1932	91	89	93½
Virginian Pwr	5s	1942	93½	88	96
Virginian Pwr	6½s	1954	101½	99	102½
Virginia Ry. & Pwr.	5s	1943	97½	93½	99
Wagner Elec. Mfg.	7s	....	*b*101½	100	102
Washington Coast Util.	6s	1941	101½	99½	101½
Washington Wtr. Pwr.	5s	1939	100½	99½	101½
West Penn Pwr	5s	1963	98½	93½	99½
West Penn Pwr	5s	1946	98½	93½	100
West Penn Pwr	5½s	1953	103½	100½	105½
West Penn Pwr	7s	1946	106½	104½	107½
West Virginia Lt., Ht. & Pwr	6s	1929	100	95	100
West Virginia Utilities	6s	1935	95½	91	98
Westchester Ltg	5s	1950	101½	98	102
Western Elec	5s	1944	100½	98	101½
Western N. Y. Utilities	5s	1946	96½	90½	97
Western Pwr	6½s	1954	100	97	100½
West. States Gas & Elec	5s	1941	97½	95	99½
West. States Gas & Elec	6s	1947	99	97	100½
Westinghouse Elec. & Mfg	7s	1931	106½	105½	108½
Wisconsin Elec. Pwr	5s	1954	98½	93½	99½
Wisconsin Gas & Elec	5s	1952	99	97	100½
Wis.-Minn. Lt. & Pwr	5s	1944	95½	93	96½
Wis. Ry., Lt. & Pwr	5s	1933	92½	87½	93½
Wis. River Pwr	5s	1941	90½	88	92½
Yadkin River Pwr	5s	1941	98½	96½	99½
Yarmouth Lt. & Pwr	5s	1937	83	82	87
Yarmouth Lt. & Pwr	8s	1951	98	97	102

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco. *t*Bid, low, high, Tuesday, Nov. 10. *j*Bid, low, high, Wednesday, Nov. 11. *k*Latest quotations available.